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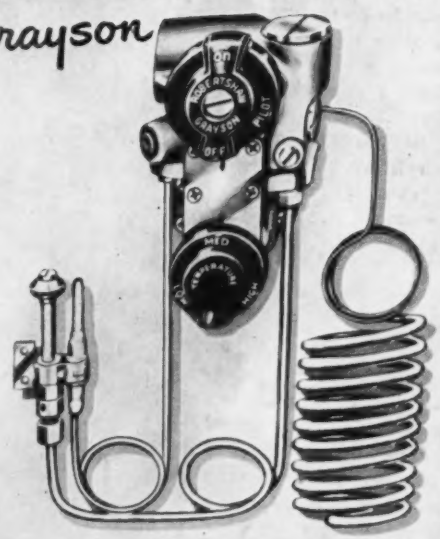


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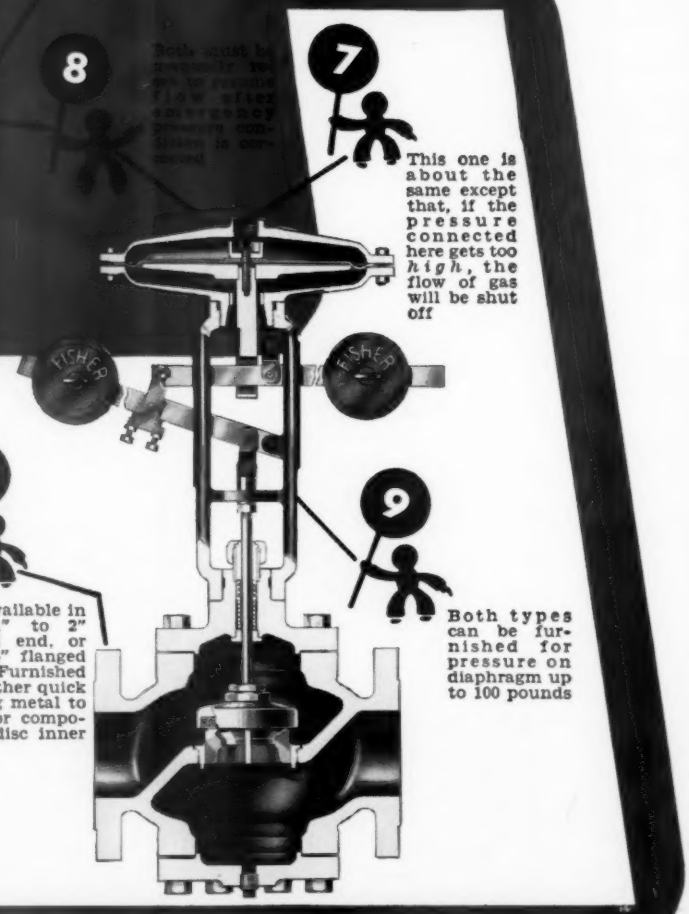
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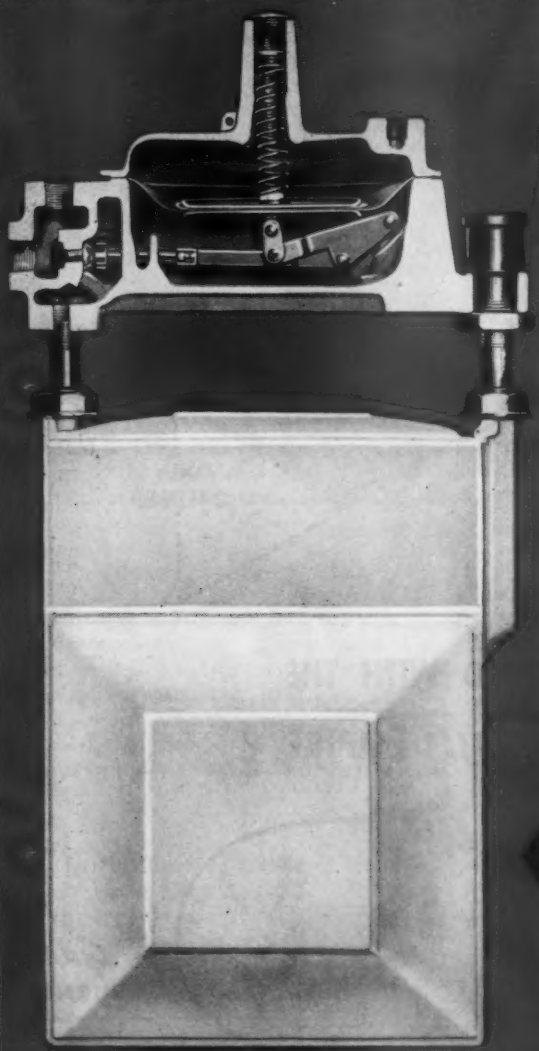

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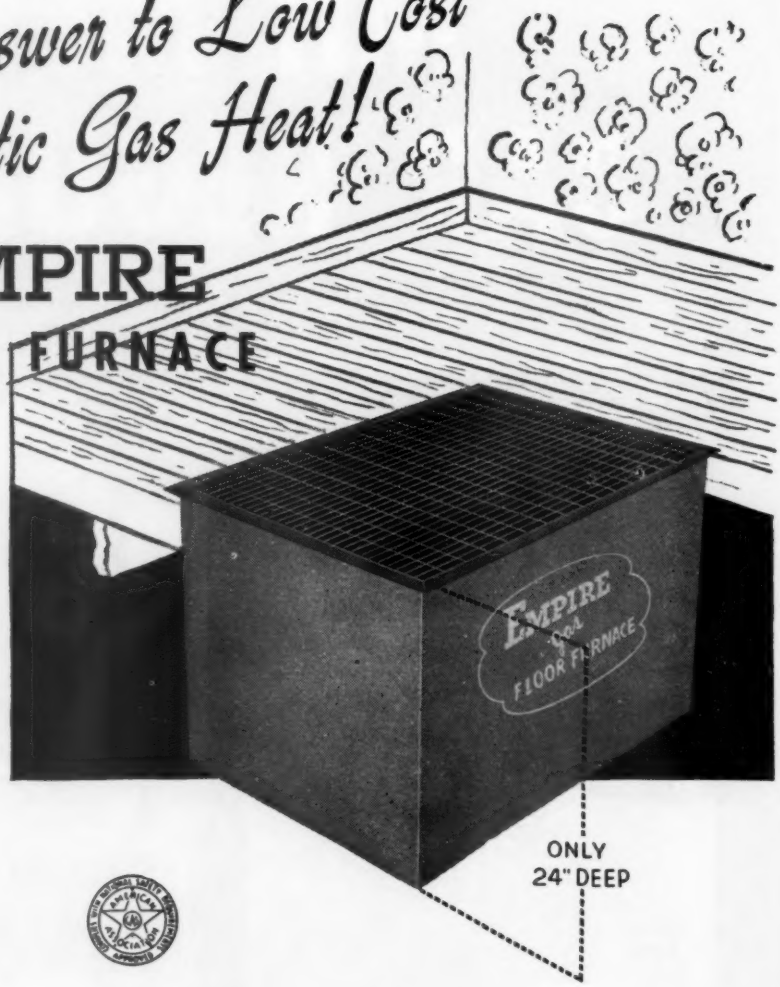


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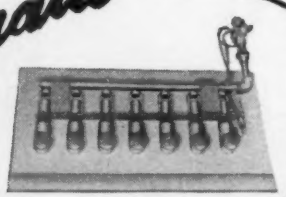

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AMERICAN Gas Journal
ESTABLISHED 1859

VOLUME 175 AUGUST 1951 NUMBER 2

## This month...

The first seven chapters in our American Gas Fundamentals series are now being reprinted and will be available free of charge, upon request, to new subscribers to AMERICAN GAS JOURNAL. We say new subscribers on the assumption that all of our old subscribers have carefully clipped each installment and are accumulating them into a permanent text book. At least, that is what we advised them to do when the series started in January.

• • •

A letter from Gordon Calderwood, of Rochester Gas and Electric Corp., notes that a none-too-bright typographical error appeared in his paper "Safety Is No Accident" as it appeared in our July issue. On page 21, Col. 1 we had him saying "When the $CO_2$ content of the mixture reaches 4.5 all that is needed for a disastrous explosion is a source of ignition." What he really wrote, of course, was: "When the $O_2$ content of the mixture . . . etc." If $CO_2$ could cause an explosive mixture, it certainly would have raised particular Hob with the chimneys of America long before now.

• • •

We seldom prophesy, but nevertheless we do predict that some of the big manufactured gas companies that are now planning on straight natural gas distribution will take another long look at their hole card, in the form of pipe line deliverability, before they embark on their 1952 conversion programs. And those who don't may live to wish that they had.

• • •

The big new 1951 edition of the *Handbook* will be ready for mailing August 24, the printer says. We sincerely hope so. We are running out of both postcards and plausible excuses for the long delay. Our only consolation: It will be worth waiting for.

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**Charles R. Bellamy · Technical Editor**
**Arthur Rohman · Western Editor** **John F. Falvey · Financial Editor**

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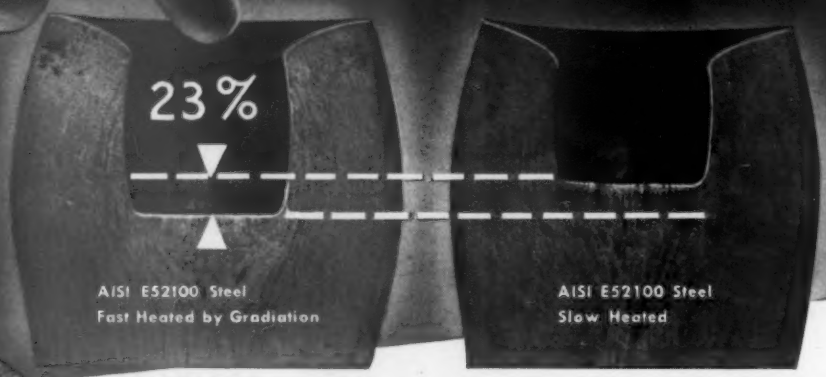


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# Editorial:

## Self Imposed Restrictions

THE Bow amendment to the Defense Production Act, which has now been enacted into the Federal law, would appear to block for the moment any further attempts by the Petroleum Administration for Defense to issue a nation-wide order prohibiting the use of natural gas for new house heating or other large volume loads without PAD approval.

The Bow amendment says, in substance, that so long as any state regulatory body has the gas supply and demand situation under control, the Federal agencies shall issue no rules or restrictions applicable to service in that state.

This may or may not prove to be a victory for the natural gas utilities. Judging from the enthusiastic truculence with which the Gas Appliance Manufacturers Association jumped into the fight, when the first inkling of a restrictive order leaked out of Washington, the casual reader might well assume that the entire gas industry views any sort of limitation as a fate tantamount to death.

We agree with GAMA that the idea of a blanket, nation-wide prohibition on new gas installations was hastily conceived and not justified by the circumstances. It is a regrettable characteristic of most Federal agencies and their administrative heads, that they seek to solve every problem by first of all forbidding everything under the sun after which they attempt to mitigate the unnecessary severeness of their acts by granting grudging exceptions.

But the gas companies themselves well recognize that there are areas in which restrictions and limitations on any new large scale uses of gas must be imposed now, and must remain in force until new gas transmission facilities have caught up with the projected winter peak demands. In such areas where restrictions on house heating are not already in effect, it becomes the clear obligation of the gas utilities to lay the proper information before their state regulatory commissions so that necessary orders may be issued before any increase in load can imperil next winter's gas service.

GAMA was a voluble and effective voice against a national blanket proscription on new house heating. In that particular fight, GAMA assumed the position of spokesman for the entire industry. But GAMA's principal concern was over the large inventories of its manufacturer members and their dealers who are loaded down with unsold heating equipment. That is a legitimate position for that trade association; but it is not, and should not be, the crux of the problem as far as the utilities are concerned.

Their obligation is for the delivery of dependable uninterrupted service to the consumer under any foreseeable conditions. The gas company, and only the gas company, is in a position to say how far it can expand its load and still allow an adequate margin of safety to guard against service interruptions or failures due to inadequate gas supplies.

No doubt some customers will grumble when they find that they cannot immediately get natural gas for house heating, particularly in those areas where gas commands no premium price over coal or oil. But the grumbling will be strictly a pianissimo murmur compared to the howls of indignation that would arise if service were undertaken by the gas company, and the supply of gas should fail on some bleak and frigid night deep in the frozen watches of winter.

It is because they recognized the seriousness of the problem that lies ahead that some gas companies were only lukewarm at best in their opposition to the proposed PAD order. But now, with such an order forestalled by specific congressional action, the responsibility for accomplishing the ends at which the order aimed is in a large measure transferred to the local gas utilities, and through them to their state commissions.

If the industry can so plan its load, and so govern its expansion into house heating and other large volume uses that the greatest possible service is rendered to the public, at the least possible risk of service failure, then, and only then, will the Bow amendment be a victory for gas.

## No Good News

A RECENT prediction of brightening skies for possible early export of Canadian natural gas into the Pacific Northwest is, we fear, another case of the wish being father to the thought.

Our contacts in Alberta do not share the view that permission to export gas is in any sense imminent. They point out that since the Conservation Board made its report in January of this year there has been no substantial change in proven gas reserves.

The restricted permit obtained by the Montana Power Company some months ago appeared as a possible opening wedge in the Canadian wall of opposition to the export of natural gas. But this contract was very limited in nature, and was granted only because of the representations by Charles E. Wilson to the Canadian government and thence to the Province, that on account of the gas shortage in Montana one of the Anaconda plants was in danger of having to close down. The permit when granted was limited to ten million Mcf per year, and was subsequently reduced the first year by five million Mcf on the grounds that that amount was adequate for the Anaconda operation.

Even if steel were available for the line, it is now apparent, in the opinion of our Alberta informant, that 1954 or 1955 will be the earliest possible date by which Alberta may be ready to authorize the export of natural gas to Washington and Oregon.

Elliott Taylor

# New Instrument Designed to Disclose Odor Concentration Levels in Gas

by C. Eldon White

San Diego Gas and Electric Company

HOW shall the distribution man know when gas is no longer safely odorized? Does the smell of gas depend upon the odorant dosage? It recently became imperative to have an odor-test answering these questions within a few seconds. A newly designed non-mechanical portable odorimeter, plus a rational, simple odor-standard have resulted.

We now check the odor level in our purchased natural gas. It is possible that a daily fluctuation may arise because of our distance from the odorizing centers. Odorant may be lost in transmission-main drippage, and certain mercaptans are reported to be partially destroyed at times by oxidation on the inside walls of mains.

First, we succeeded in putting odor on a numerical basis. Some confusion existed between concentration of odorant as a material and the resulting smell. Odor exists only for the nose. We found that the nose, contrary to general impression, is a surprisingly accurate judge of odor intensity. It is well-known that any odorant may be diluted to such a low concentration, called the *threshold*, that, although present, it can no longer be smelled. Our experiments showed that numerically the true odor (smell) must be expressed in terms of the *logarithm* of the threshold concentration of odorant material, not as the plain threshold. This will be explained later.

But for practical purposes, we have adopted a much simpler and perfectly logical method as monitor for low odor levels.

Now gas is odorized so that it can be smelled in mixture with air before it accumulates in dangerous concentration. Our natural gas has no carbon monoxide; hence this concentration is the lower flammable limit. Then the lowest amount of natural gas in air that can be smelled must lie safely below the lower flammable limit. Obviously, higher concentrations can then also be smelled.

## Basic Odor Standard

Thus the nose is the final judge of odor. Total sulphur is not necessarily a primary measure of smell, nor is an instrumental recording of sulphur complexes. How shall we harness the sense of smell? Fieldner *et al (1)* state: "When using warning agents as an aid in averting explosive mixtures of gases, it was decided that the agent should be present in the gas in amounts sufficient to give warning when the gas in the air has attained a quantity equal to one-fifth of the lower flammable limit." The lower flammable limit of natural gas in air is about five per cent, so a mixture of one per cent of natural gas in air should smell. The Railroad Commission of Texas *(5)* legalized this: "The use of that quantity of odorant which will effectively odorize natural gas when the gas is present in concentrations of not greater than one per cent of room volume, as determined by a room test, is considered satisfactory." If toxic carbon monoxide were present, the percentage would naturally be modified *(1)*.

A practical standard, we felt, need include only: (a) The specific concentration of natural gas (as one per cent in air below the lower flammable limit which it is agreed must have a perceptible smell, (b) a fresh, unfatigued nose, or at least a sense of smell of known fatigue, (c) an average nose, *i.e.*, the average sensitivity of several smellers, (d) an instrument for quickly diluting odorized gas to any standard concentration as in (a).

We have therefore adopted as our standard the one per cent rule and the daily use of a unique odorimeter requiring no electrical or mechanical power for its operation. This combination has been a satisfactory monitorial tool.

The whole odor spectrum of gas from 0 per cent to 100 per cent by volume in gas-air mixtures can indeed be measured with the odorimeter (see later), but the process is unnecessary for monitory needs.

## Instrumentation

The elaborate closed room procedure *(4)* is valuable for primary or occasional surveys of odor strengths and dosages made at a restricted number of places. It could probably be formulated to express the numerical relation of threshold to the lower flammable limit (basically the only fixed point to consider for odorization), or the rate of fatigue of the sense of smell with time of exposure to, and the concentration of, the odorant, etc., thus converting it to a conventionally rigid standard. But it requires several man-hours per test, and is certainly not portable. Hence a rapid, portable odorimeter should prove more useful as a control over a wider area.

## A New Odorimeter*

The purpose of the instrument* is to determine whether a fuel gas when diluted to a standard degree, less than the dangerous concentration, still has enough odor to warn of its presence, or alternatively to evaluate numerically the odor level of a gas by psychometric measurements according to Weber's law.

This instrument completely extracts a known proportion of odorant from the gas, in effect diluting the odorant to any desired fraction of the original content; the odor of the resulting gas may be judged as present or absent, etc. The effect on the odor is the same as if the odorized fuel gas had been diluted with the same proportion of air.

A novel feature is that the odorimeter is operated solely by a single stream of gas flowing from a main; this gas alone furnishes the power, whereas other odorimeters *(4, 6)* require not only the gas whose odor is to be measured, but also auxiliary equipment to furnish a simultaneous flow of air or other odorless medium for dilution, as for example, an air-compressor or blower with electric motor, or a large air-filled room plus electric fan, etc.

* Patent pending.

Figure 1 shows a model of the new odorimeter built, for display, chiefly of transparent Lucite. For field use sturdier material is preferred. Odorized gas from the main enters a single inlet at the rear of the instrument, goes through a regulator, and divides into two branches, each provided with a flowmeter and needle valve, so that any relative flow of gas in the two branches may be simply obtained. One of the branches is provided with a cannister of long-lived activated carbon, which removes every trace of odorant from the gas. Then the odorized and deodorized gas streams meet, mix, and pass (according to the position of the selecting knob on the front panel) either to a purging vent, or into the smelling funnel on top. The nose, in the latter case, is inserted into the funnel, and a long, slow inhalation brings the gas to the sensory organs; the degree of odor is estimated rapidly and easily. The degree of dilution of the odorized gas in the odorless gas, or strictly speaking, the proportion of odorizing substance still remaining in the gas, is calculated from the flowmeter readings. An advantage is that both flowmeters are at the same temperature and pressure, and pass the same gas (except for the negligible trace of odorant); hence they need only be calibrated with air, and no corrections are applied during the test. The pressures may be equalized precisely by the addition of choke valves and a differential manometer; this is hardly required for field use. A total flow of 1/3 cu. ft. per minute is suitable.

Two models of this odorimeter have been used daily for some time as monitors of the odor of our gas at the one per cent level, a value which is extremely lenient. Good correlation was obtained with a closed room test at one per cent.

## Monitor Procedure

Our standard says that one per cent of natural gas by volume in air must smell. Turn on the gas, set the odorimeter to one per cent, smell. That is all.

## Weber's Law

We have performed a limited series of 17 smelling tests with the odorimeter, which appear to verify the ability of the nose to judge odor-intensity, the obedience of odorized natural gas to Weber's law, and the reliability of the odorimeter for measuring the odor-intensity of such gas. The experiments may encourage the adoption of psychometric methods for evaluation and control of odorant materials.

Weber's law is generally accepted for smell. Thus Gamble *(2)*, and Fieldner *et al (1)* and Katz & Talbert *(3)* in coöperative tests with the American Gas Association, confirmed the principle. Weber's

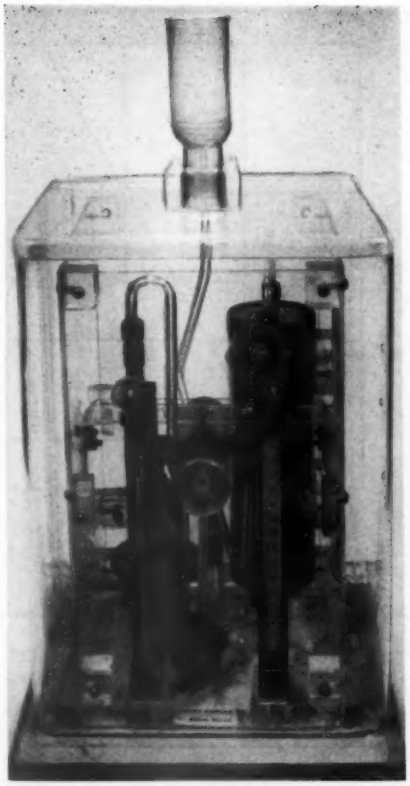

Fig. 1—Odorimeter.
(Patent Pending)

law recognizes, in effect, that the intensity of a given sensation can be judged not only as more or less than some reference, but with surprising accuracy can be assigned a relative numerical value with respect to the reference. Thus, the nose can numerically evaluate the relative intensity of odors with ease and but little training. When the judged sensation is plotted against the logarithm of the stimulus, a straight line defines the points:

$$A = m \log c + b,$$

where $A$ is the sensation, $c$ the stimulus, and $m$ and $b$ are constants. Ordinarily $A$ is a relative sensation, except at the threshold value for $c$, at which point $A$ becomes a constant (zero) and the threshold concentration becomes an intensive property of the system-observer. The threshold is the stimulus at and below which sensation is imperceptible. Translating this to odor, $c$ = concentration of odorant in odorized gas, $A$ = odor-intensity perception, while threshold is that lower value of $c$ at which odor-sensation just disappears. *We must therefore distinguish sharply between concentration of odorant and degree of odor-sensation (smell).* Threshold can be determined by trial-and-error, but it is an elusive point occurring at the puzzling lower limit of conscious perception. It can also be measured according to Weber's law by extrapolation of data in the region of greater sensory perception, after the manner of any physically measured zero determination. A number of smellers may increase the statistical accuracy of such psychometric testing. It might seem immaterial whether the reciprocal of the threshold, or the logarithm of said reciprocal, be taken as the measure of odor intensity; actually, large errors arise from neglect of the logarithmic nature of the odor-odorant relationship. There seems to be no other relationship within the limited range of odors we have encountered in gas odorization. Often only a few sensory measurements will establish the entire odor spectrum (see below). Weber's law can be used as a guide to odorant practices, as the following examples indicate.

## Examples

Assume in all these examples that we start with odorized gas with a standard or datum threshold of 1/1,000, that the composition of the odorant is uniform, and that we consider the odor-sensation (smell) of any standard gas-air mixture above the threshold, say one per cent of gas + 99 per cent air.* The principle is: The concentration of odorant material in gas varies as the reciprocal of the threshold, but the odor (smell) varies as the logarithm of that reciprocal.

(1) At a distant place, if the threshold has risen to 1/150, the true odor-sensation of our one per cent mixture is not 150/1,000 = 15 per cent as great, but (log 150)/(log 1,000) = 72 per cent as strong as before. The odor is only slightly influenced by the loss of 85 per cent of the odorant.

(2) Let us try to double the odor-intensity of our one per cent mixture: Weber's law shows that we must increase the odorant injection, not to double, but to 1,000 times the standard dosage! For the logarithm of the reciprocal of the threshold will be doubled, becoming 2 log 1,000 = 6; the new threshold is 1/1,000,000, and the dosage of odorant is 1,000,000/1,000 or 1,000 times the standard dosage!

(3) Let us inject only ½ the datum dosage of odorant. The true odor-intensity of our standard one per cent mixture, as judged by the nose, will still be 90 per cent as strong as before; for the new threshold will be 1/500, and the new odor is (log 500)/(log 1,000) = 90 per cent as strong as the datum odor.

In all cases, the odor-sensation at or below the threshold is, by definition, con-

* The remarks apply equally well to any such standard mixture above the threshold, e.g., 100 per cent gas + 0 per cent air.

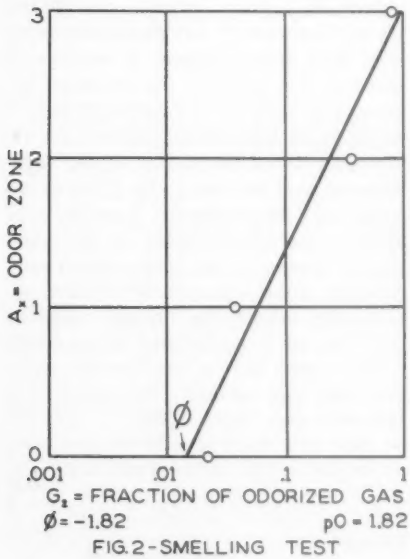

FIG. 2 - SMELLING TEST

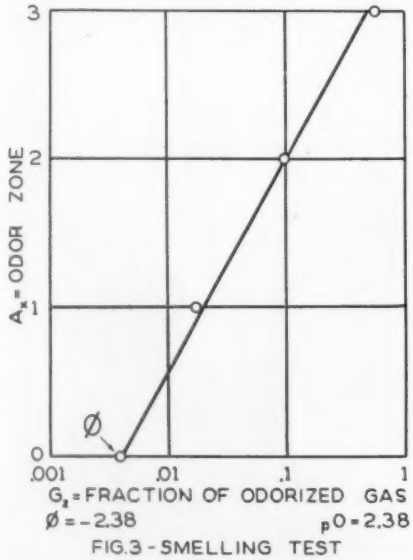

FIG. 3 - SMELLING TEST

stantly zero, no matter how variable the threshold may be.

## Suggested Scale of Absolute Odor-Intensity

It became evident from our experiments that the logarithm of the reciprocal of the threshold, which can be measured by smelling tests, can be used as a measure of the relative odor of natural gas. A convenient absolute odor scale, similar to the hydrogen-ion scale, may therefore be constructed. Thus, relative odor being directly proportional to $\log_{10}$ (1/threshold), we may define as the absolute odor value of undiluted gas, or any fixed standard dilution thereof if more convenient, the value

$$\text{absolute odor} = \text{pO} = \log_{10}(1/\text{threshold}),$$

wherewith a simple numerical concept of odor-intensity independent of such ideas as pounds of odorant per MMcf, percentage of sulphur, etc., is established. Table I exemplifies such a scale.

## Smelling Tests

A wide-range model of the odorimeter was used. Mixtures of odorized gas from the laboratory line of 0.01 per cent to 100 per cent concentration were presented at random to one of a number of persons. The flowmeter readings, hidden from the smeller, were recorded. The smeller was requested not to think, but to depend upon his subconscious perception, and to rate the odor by percentage, based upon his recollection of the odor of undiluted natural gas as 100 per cent. His estimate was recorded. A recess was taken between smells to clear the nose; because of this and the brief period of smelling, it is thought that little or no nasal fatigue resulted. About twenty such tests were made within an hour. The smellers, inclined to be skeptical at first, were soon surprised to find that odor intensities were readily judged as percentages. An attempt to have the smeller report in words like "odorless," "weak," "medium," and "strong" resulted in his confusion; but numerical evaluation was readily acceptable. The final graphs showed that any smeller's estimates were harmonious. But it soon became apparent that four degrees could be well differentiated in the available range of odors, for natural gas after all is not excessively odorized, and that each smeller reported within a definite group of percentages for each of the four ranges. It is characteristic of such tests that small differences in stimulus are not distinguishable. Accordingly, his reported percentages were grouped into four relative intensity zones, after the manner of Fieldner *et al (1)* and Katz & Talbert *(3)*: Zone 0 (no odor), 0 per cent; Zone 1 (weak odor), 1-20 per cent; Zone 2 (medium odor), 21-60 per cent; Zone 3 (strong odor), 61-100 per cent +.

TABLE I
Suggested Scale for Odor Level

| Threshold | pO = Absolute Odor |
|---|---|
| 1/10 | 1.00 |
| 1/100 | 2.00 |
| 1/150 | 2.18 |
| 1/1,000 | 3.00 |
| 1/2,000 | 3.30 |
| 1/10,000 | 4.00 |
| 1/100,000 | 5.00 |
| 1/1,000,000 | 6.00 |

For each series a plot was made, with intensity zone ($A_x$) as ordinate, and logarithm of average concentration of odorized gas in the mixture (log $G_2$) as abscissa; this turned out to be a straight line.

The smeller's judgment always improved notably on his second and third day. No other training was given. The only prerequisites seemed to be a coöperative attitude and a thoughtful, relaxed mind.

Table 2 is a classified transcript of one such series, showing the random sequence in which the test was administered, the concentration of odorized gas ($G_2$) as a decimal, the odor estimates of the smeller ($A$), and the grouping into odor zones ($A_x$). The average of $G_2$ in each zone was plotted on semilogarithmic paper against $A_x$ (see Fig. 2). The points define a straight line. The log $G_2$-intercept is marked Φ. Here the threshold is $\log^{-1}\Phi = \log^{-1}(-1.82) = 1/66$; the absolute odor value therefore is pO = 1.82. Obviously this batch of natural gas was poorly odorized; thresholds much lower than 1/66 are desirable.

Figure 3 is a similar semilogarithmic plot of a test made by another smeller at a later time. Again the reported odor percentages are grouped into zones; each point as before is derived from the average of all concentrations of odorized gas smelled within each zone. Here, Φ = log (threshold) = −2.38; therefore the threshold is 1/240, and the absolute odor value of the gas is pO = 2.38. Even here the gas appeared not too well odorized.

Figures 2 and 3 are typical of the correlations obtained in all the experiments, although lower thresholds were found on later occasions. Straight lines resulted in all cases in accordance with Weber's law.

While the odor zones are relative, still the threshold is an absolute value. The straight line indicates the absence of synergism. Therefore, if the odor intensities were referred to an absolute basis, the line would pass through the same point Φ, but would have a different slope. Then the equation could be written

$$A = m \log G_2 + A_2,$$

where $A_2$, the $A$-intercept, is the absolute odor of 100 per cent natural gas. This differs from the original

$$A = m \log c + b$$

because there $c$ is the concentration of straight odorant, and $b$ is the maximum absolute odor of the odorant itself, but here $G_2$ is the concentration of odorized gas in the mixture and $A_2$ is the odor of 100 per cent natural gas, which is by no means saturated with odorant. It can be shown that with a given odorant and smeller, for varying degrees of odorization the graphs on an absolute basis will yield parallel straight lines, that the values of $A_2$ will vary numerically with Φ = log (threshold), and that as Φ de-

creases, $A_2$ increases. Hence $A_2$, the absolute odor intensity of undiluted odorized gas, varies as $-\Phi$, *i.e.*, $A_2 = \text{const.} \times pO = \text{const.} \times \log (1/\text{threshold})$. Then if the constant be taken as unity, we attain the previous definition, $pO = \log (1/\text{threshold})$. This definition is rigidly true only if $m$ is constant; fortunately, $m$ appears virtually constant for all odors in the useful or measurable range *(1, 2, 3)*.

Analytic geometry also shows that the threshold varies inversely as $c_2$, the specific concentration of odorant in a given batch of straight natural gas. Then letting $A_2$, $\Phi$, and $c_2$ resp. be the odor intensity, log threshold, and odorant concentration, while $A_2^\circ$, $\Phi^\circ$, and $c_2^\circ$ are the corresponding values for gas with a desirable standard degree of odorization, it is easy to show that $\log (c_2^\circ/c_2) = \Phi^\circ [(A_2/A_2^\circ) - 1]$, an easy way to calculate the relationship between relative concentration of odorant, $c_2^\circ/c_2$, and relative odor level, $A_2/A_2^\circ$, provided the threshold can be determined experimentally with the odorimeter.

Individuals vary in threshold-sensitivity; hence, as mentioned, several smellers might participate. An artificial standard odor like Wilby's *(6)* apparently compensates individual differences; but we believe that Wilby's a priori measure of odor levels, *viz.* the arithmetic ratio of the reciprocals of thresholds, should be superseded by the logarithmic ratio according to Weber's law as we have shown, since it is not evident that Weber's law is inapplicable. An arithmetic variation in odorant concentration or threshold invariably results in a geometric variation in odor perception.

Thus, the smellers report relative odors, except at the threshold. The threshold is an absolute point for a specific smeller, logarithmically related to the absolute odor of natural gas as shown. Our tests indicate, we believe, the validity of Weber's law for the odors encountered.

The classic statement of Weber's law as confirmed by Gamble *(2)* is that if $\Delta A = \text{const.}$, then $\Delta c/c = \text{const.}$ These are readily combined and integrated to the above form $A = m \log c + b$, then transformed algebraically to $A = m \log G_2 + A_2$.

*Acknowledgments:* To C. P. de Jonge for encouraging, to L. J. Willien for suggesting a one per cent standard; to M. R. Engler for constructing the Lucite model; to those members of the Gas Meter Division acting as smellers.

TABLE II

Data for Smelling Test (see Fig. 2)

| Smelling Sequence | Relative Odor | $A_x$ = Odor Zone | $G_2$ = Odorized Gas Concn. | A = % Odor per Smeller |
|---|---|---|---|---|
| 13 | None | 0 | 0.000* | 0 |
| 8 | " | 0 | 0.0222 | 0 |
| 20 | " | 0 | 0.000* | 0 |
| | Avge. | 0 | 0.0222 | |
| 3 | Weak | 1 | 0.0102 | 10 |
| 7 | " | 1 | 0.0457 | 10 |
| 12 | " | 1 | 0.0116 | 10 |
| 14 | " | 1 | 0.0986 | 20 |
| 19 | " | 1 | 0.0211 | 10 |
| | Avge. | 1 | 0.0374 | |
| 1 | Medium | 2 | 0.472 | 60 |
| 4 | " | 2 | 0.0963 | 30 |
| 5 | " | 2 | 0.323 | 30 |
| 6 | " | 2 | 0.214 | 50 |
| 11 | " | 2 | 0.472 | 50 |
| 16 | " | 2 | 0.214 | 60 |
| 17 | " | 2 | 0.047 | 40 |
| 18 | " | 2 | 1.000 | 60 |
| | Avge. | 2 | 0.355 | |
| 2 | Strong | 3 | 0.768 | 80 |
| 9 | " | 3 | 1.000 | 80 |
| 10 | " | 3 | 0.772 | 70 |
| 15 | " | 3 | 0.312 | 70 |
| 21 | " | 3 | 1.000 | 70 |
| | Avge. | 3 | 0.770 | |

* Control; omit from average.

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# MISSING: 15,000 Stockholders

UNCLAIMED securities valued at $3,000,000, and accumulating cash dividends at a present rate of more than $200,000 a year, are awaiting 15,000 stockholders of The Commonwealth & Southern Corp., and have been since October 1949. These stockholders, throughout the United States, are the objects of a search by the agents of Commonwealth acting under orders of the Securities and Exchange Commission.

Commonwealth & Southern, once headed by the late Wendell L. Willkie, was dissolved in October 1949 in accordance with the "death sentence" provision of the Public Utility Holding Company Act of 1935. The dissolution plan of Commonwealth called for distribution of its subsidiary company stocks to its stockholders. The dissolution followed years of costly litigation directed by Mr. Willkie and his associates in an effort to defend the company against a breakup, and protect its stockholders, who numbered 160,000 at one time. There were approximately 116,000 stockholders at the time of dissolution.

Securities of Commonwealth's former subsidiary companies, with a present market value exceeding $350,000,000, have already been distributed to essentially all of the company's 14,000 pre-

ferred stockholders and 87,000 of the company's 102,000 common stockholders. These securities are currently paying cash dividends at a rate of more than $23,000,000 a year.

Subsidiary companies of the former Commonwealth system, and which are now independent, include Consumers Power Co., Central Illinois Light Co., Ohio Edison Co. with its subsidiary Pennsylvania Power Co., and The Southern Co. with its subsidiaries, Alabama Power, Georgia Power, Gulf Power and Mississippi Power companies.

### Holding Company Breakup

In the breakup of Commonwealth, the 102,000 common stockholders who owned over 33,600,000 common shares of Commonwealth, received common stocks of The Southern Co. and Ohio Edison Co., having a present market value of $192,000,000. The 14,000 preferred stockholders, owning over 1,400,000 Commonwealth preferred shares, received common stocks of Consumers Power and Central Illinois Light companies with a present market value exceeding $160,000,000.

What has become of the 15,000 stockholders entitled to these securities, or what leads to lack of action, is probably a commentary on similar situations in matters involving unclaimed savings deposits, insurance policies and securities. Deaths, family breakups, loss of valuable papers, moving without any known forwarding address, sales or gifts without transfers or other records, and plain failure to read or follow up mail, undoubtedly account for thousands of these situations in closing up a business.

After October 1, 1951, all securities unclaimed will be sold for cash and the proceeds held for the account of such holders until October 1, 1954, when unclaimed cash will become the property of The Southern Co.

## Iowa-Illinois Plans to Build $1,000,000 Pipe Line

Iowa-Illinois Gas and Electric Company, of Davenport, Iowa, has filed an application with the Federal Power Commission in connection with the proposed construction of a 41 mile pipe line in Iowa to provide capacity to serve increased loads and to protect service to the Iowa City and Cedar Rapids areas.

The proposed line, estimated to cost $1,000,000, would connect with the main line of Natural Gas Pipeline of American in Washington County and extend northerly to Cedar Rapids. The line, to be of 10-inch diameter pipe, would parallel an existing feeder line.

The application says that the firm daily requirements for the Iowa City district are now 5,400,000 cu. ft. and for the Cedar Rapids district, 15,600,000 cu. ft. These requirements are expected to increase to 15 million cu. ft. and 45 million cu. ft., respectively, within the next 10 years, the company said.

# Frequency & Severity Are Accident Criteria

by W. H. Adams

Manufacturers Light and Heat Co., Pittsburgh

Chairman, AGA Accident Prevention Committee

OF all the charts and graphs and lists that safety statisticians produce each year, two receive the lion's share of attention and study. These are the accident frequency rate and the accident severity rate. Frequency tells us how many accidents an industry (or plant) had. Severity tells us how bad these accidents were. Frequency and severity tell the accident story. Other figures and rates paint the lily.

Here's the story on the gas industry frequency and severity rates—the accident story.

In 1950 the gas industry frequency rate was a little over 16; for every million hours worked, there were 16 disabling injuries. The 1950 rate was 11 per cent lower than the 1949. 1950 was also the third year in which the frequency rate had fallen.

Is a frequency rate of 16 good? Not very. It is considerably higher than the nationwide industrial rate; considerably higher than the rates of the two industries whose work conditions are most similar to the gas industry—the petroleum and electric utility industries.

The nationwide industrial frequency was 9.3—42 per cent lower than the gas industry.

The petroleum industry frequency rate was 10.08—37 per cent lower than the gas industry.

The electric utility frequency rate was 11.96—25 per cent lower than the gas industry.

Of the 40 major US industries, the gas industry frequency rate ranked 32nd. The nationwide rate, in 1950, was at its lowest point in history. The gas industry rate was 40 per cent higher than its own best year (1933).

In number of accidents the gas industry makes a poor showing when compared to:

—the nationwide industrial average.
—industries with similar work hazards (petroleum and electric utility).
—its own best accident year.

Now for the brighter side—the gas industry severity rate.

In 1950 the severity rate was .79—for every 1,000 hours worked, the time charged off for each disabling injury was 49 days. In other words about six hours out of every 1,000 hours were lost or charged to accidents. This rate was over 20 per cent lower than the 1949 severity rate. It was the second lowest figure ever recorded in the gas industry.

The gas severity rate ranked 19th out of the 40 major US industries. It was six per cent better than the petroleum severity rate, 60 per cent better than the electric utility rate, and almost 16 per cent better than the nationwide severity rate.

The gas industry, then, had a higher-than-average number of accidents, which, generally, were less-serious-than-average. A gas industry worker is more likely to be injured but is less likely to be injured seriously than in these other industries.

In this respect the gas industry is like a community suffering from a plague. Like any epidemic that strikes a community accidents and their causes can be isolated and the germs stamped out.

### 1950 Summary

Here's what the many minor injuries added up to in 1950 in the gas industry. (Computed on data covering 90 per cent of the employees).

*Disabling injuries*—5,377

*Time charge for disabling injuries*—264,775 days (Figure includes actual time lost from work and days compensation paid for deaths and permanent disabilities. For example, an accident resulting in a fatality is charged with 6,000 working days.)

*Costs of disabling injuries*—$2,500,000.00 (Based on a National Safety Council study of direct and indirect accident costs in 36 typical companies.)

*Good will losses due to interruptions and delays in service*—inestimable. The conditions that bred over 5,000 disabling injuries in the gas industry last year also were responsible for a good many of last year's service interruptions. Disabling injuries and disrupted service go hand in hand. No one can gauge the costs to the gas industry for service disruptions. Such costs can only be measured in the intangibles of "good will" and "public relations." Continuous service—upon which good will is built—is the life blood of the gas industry, as it is of any public service organization. So we can charge to the accident ledger, too, "X" dollars in good will.

We have been slow to learn that there is no such thing as an unimportant accident. Minor or serious, spectacular or

*(Continued on page 32)*

# So Cal Expands Radio Facilities to Link Entire Transmission System

by Harry J. Keeling

Southern Counties Gas Company, Los Angeles

NEW efficiency through the use of radio communications is the goal of the Southern California Gas Company, Southern Counties Gas Company and Pacific Lighting Corporation, who are completing the installation of the most modern radio communications system operated by any utility company in the United States. The new radio communications system is intended primarily for use in operation and maintenance of the company pipe lines, and especially for use in any emergency that might arise.

Radio equipment for the inter-company communications system includes 11 fixed stations now in operation and another six under construction, 72 mobile units for installation in maintenance trucks and patrol cars, three "pack" sets and nine Motorola "Handie-Talkie" units for field use. Two repeater stations, needed to maintain constant contact with mobile units operating in desert and rugged mountainous country, were installed atop mountain peaks near Blythe and Indio.

Since 1941 the three gas companies have been operating radio equipment on a frequency of 2.292 megacycles. The Federal Communications Commission has since discouraged all expansion on that frequency and recommended that utility companies change over to the very high-frequency 160 megacycle band. To comply with this recommendation, and also to take advantage of the many technical improvements in radio since the war, the companies decided to replace present equipment and expand radio facilities to link all parts of its integrated transmission systems.

The 30-inch Texas-California pipe line, which brings gas from West Texas and southeast New Mexico to the California border, was built by the El Paso Natural Gas Company. The California portion of the pipe line, consisting of a 30-inch line from Blythe station on the Arizona border to Santa Fe Springs, a distance of 214 miles, and 10 miles of 26-inch pipe from Santa Fe Springs to

Control console at a maintenance station on the Texas-California pipe line: Mr. Keeling (left) watches J. F. Miller, pipe line repair foreman, test the new equipment.

Operation of a mobile radio unit in a "jeep" station wagon is demonstrated by Henry Kondler, Southern Counties Gas Company. Station wagon is equipped with four wheel drive for mountain climbing in maintenance work.

Spence Station, East Los Angeles, was built and is jointly owned by the Southern California and Southern Counties Gas companies. Following completion of the line in the fall of 1947, work was started on the design of a complete radio communication system for emergency use and for maintenance work in connection with the operation of the pipe line. A leased telephone line handles traffic between maintenance stations under normal circumstances, but it is necessary to have an emergency point-to-point radio system to provide this service in case of trouble on the wire line. High mountains, and the long distance between maintenance stations, makes the problem of providing satisfactory point-to-point radio communication with reasonable power rather difficult.

### Three Surveys Made

Preliminary design work on the radio system was done in the office, using contour maps and aerial photographs to plot radio propagation paths. This was followed by field reconnaissance to determine accessibility of proposed locations and radio tests with prototype equipment to obtain actual signal strengths. Three complete radio field surveys were made throughout the length of the pipe line to determine the most satisfactory choice of frequencies.

When the entire radio communications system is completed, radio stations will be operating from the General Office in Los Angeles, and at each of the pipe line maintenance stations at Brea-Olinda, Beaumont, Indio, and Blythe. All but the Los Angeles station have now been installed. Micro-wave equipment for the downtown Los Angeles station is now on its way from the factory. Barring unforeseen delays, it should be in operation within the next few weeks. The stations at Los Angeles and Brea-Olinda will operate on 158-megacycles with 30 watt f-m transmitters, and the other stations operate with 250-watt units. These land stations are used to contact the trucks and patrol cars reporting to their respective maintenance stations.

### Precautionary Measures

All mobile units on the Texas pipe line system operate on the same frequency, enabling them to communicate directly with each other or with any of the land stations. The land and repeater stations are equipped with gasoline-engine-driven generators for emergency power supply in case the commercial power fails.

Since the Texas-California pipe line traverses desert country where summer temperatures of 125 degrees are not uncommon, all radio equipment was designed to operate satisfactorily and continuously in the temperature range between minus 20 degrees to plus 170 degrees Fahrenheit. Because of severe dust conditions on the desert, the mobile equipment was completely enclosed as a protection against the blowing sands.

Radio waves of 160-megacycle frequency travel essentially in a straight line similar to a beam of light. In cases where there is not a direct optical line of sight between a mobile unit and its associated land station, it is necessary to install unattended "repeater stations." Field tests during the planning stage indicated that mobile units operating on patrol duty between Indio and Blythe would be out of contact with their base stations for a good deal of the time, unless an unattended automatic "repeater station" was installed to relay the messages between the cars and the main stations. Such a station was then erected atop 3750-foot Chuckwalla Peak midway between Indio and Blythe. A three-and-one-half mile access road, built by the gas companies, leads to the summit where two 100-foot towers were erected.

Similar circumstances were found to exist in the area between Los Angeles and Beaumont to prevent full communication between mobile units and their base stations. In early February 1951, complete micro-wave equipment was installed on Santiago Peak, a mile-high mountain located near Santa Ana. The Santiago repeater will also be used by the Brea-Olinda station, since this maintenance station is located in a depression surrounded by hills which interfere with signals from more than a few miles away.

These unattended repeater stations will also be used for emergency communication between pipe line maintenance stations in case of interruption to the regular telephone circuits.

With the installation of the other planned radio stations, it will be possible to communicate between Los Angeles and any of the Southern Counties or Southern California headquarters bases, with the exception of those in the northern part of the Southern Counties system and the San Joaquin Valley section of the Southern California Gas Company. This station-to-station use will be limited to emergency situations, and the equipment will be used primarily within the separate divisions in the maintenance and operation of company pipe lines.

## High Proportion of Homes Built in 1950 Use Utility Gas Service

Utility gas and gas appliances had wide acceptance in new homes built in 1950 within gas company franchise areas it was proved recently by a survey made by the American Gas Association. The study revealed that where gas was available to home owners and builders on a free main extension basis more than 95 per cent of the single family dwellings and multi-family dwelling units used gas for one or more purposes.

Responses to the survey, which was intended to study major gas appliance trends in those areas where the bulk of housing construction had occurred last year, covered 565,000 new single family dwellings that were built within gas company franchise areas in 1950. About 90 per cent of these, or 513,000 new single family dwellings were entitled to free extension allowances whereby home owners and builders were not required to contribute to the cost of main extensions of gas lines. More than 95 per cent of these 513,000 single family dwellings used gas for one or more purposes with less than four per cent going wholly to competitive fuels. Individual uses for gas in this group were: cooking, 86 per cent; water heating, 89 per cent; gas space heating, 87 per cent; and gas refrigeration, about seven per cent.

Free extension privileges also were available to 138,000 new multi-family dwelling units covered by the survey and nearly 96 per cent of these used gas for one or more purposes. Individual uses of gas in these multi-family dwelling units were: gas cooking, 91 per cent; water heating, nearly 44 per cent; space heating, 41 per cent; and gas refrigeration, about 14 per cent.

The study made by the AGA Bureau of Statistics covered the use of gas in single and multi-family dwelling units built last year in major urban areas throughout the nation. Responses were received from companies serving nearly 70 per cent of the total utility gas residential customers. A total of 714,000 dwelling units was built in 1950 within franchise areas of these reporting companies. Extension of this large sample to represent the entire gas industry indicates that out of a total of 1,250,000 dwelling units built in the United States last year, about 770,000 single family dwelling units and 207,000 multi-family dwelling units were entitled to free main extension allowances within gas company franchise areas.

Only 10 per cent, or about 76,000 units of all single family dwellings built in gas company franchise areas in 1950 did not have free extension allowances. Approximately one-third of these used gas for one or more purposes. There were about 18,000 multi-family units built within gas company franchise

*(Continued on page 33)*

# Oil Gas Produced in the World's First Reverse Flow Regenerative Machine

by R. J. Horn

Central Hudson Gas & Electric Corp., Poughkeepsie

WITH the introduction of straight natural gas into its distribution systems, Central Hudson faced the problem of supplemental gas for peak shaving and emergency standby operation. Having six carburetted water gas machines suitable for conversion, together with the necessary auxiliary facilities, made it seem obviously wise to use these rather than install liquefied petroleum plants.

It was early concluded that one of the larger machines should be completely converted, and an 11′ x 11′ x 11′ machine was selected for such a purpose. The other machines were to be converted more simply at a lower investment, even though they would be less versatile in their operation. Some of the requirements this machine should meet included:

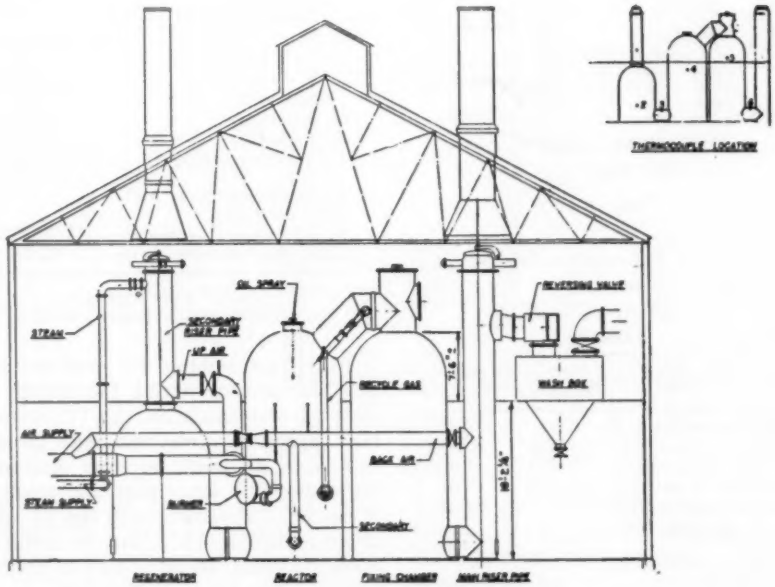
1. Continuous reliable operation
2. Uniform quality of satisfactory oil gas
3. High capacity with low carbon oil
4. Satisfactory operation with high carbon oil
5. No carbon accumulations to build up in the machine
6. A free flowing wash box
7. Controllable temperatures
8. Minimum labor per million cubic foot capacity
9. Little or no smoke and a fluid tar.

The problem then developed into finding a suitable high Btu oil gas conversion process to meet these requirements economically.

## Selection of Process and Type of Machine

Fundamental principles indicated that a regenerative cycle to maintain comparatively low temperatures in the part of the machine nearest the wash box and high temperatures in the reactor would give the necessary preferred conditions for oil cracking.

Semet-Solvay proposed a reverse flow regenerative conversion process which accomplished the aforementioned favorable conditions by the admission of reverse blast air near the wash box, thus cooling that end of the machine and burning off any carbon deposits. Also the introduction of air, and later steam, through the regenerator would give preheated air for combustion and superheated carrier steam, both of these conditions being highly desirable to accomplish a rapid rate of heat release and rapid oil gasification. This process further provided an open reactor chamber for burning the heat oil and for cracking the make oil—thus avoiding the particularly undesirable condition of building up carbon deposits on brick surfaces by frying oil on them.




3 SHELL C.W.G. MACHINE CONVERTED TO OIL GAS REVERSE FLOW

Fig. 1.

Table 1

| | *Gas Oil* | *Residuum* | *Bunker C* |
|---|---|---|---|
| Conradson carbon | 0.05 | 3.2 | 5.3 |
| Gals. heat oil per Mcf* | 2.24 | 1.90 | 2.21 |
| Gals. make oil per Mcf* | 10.62 | 10.61 | 10.65 |
| Gals. total oil per Mcf* | 12.86 | 12.51 | 12.86 |
| Gas made per hour, Mcf* | 200 | 183 | 150 |

*1000 Btu basis.

## Results and Summary

The machine was put into operation early in October 1950 on gas residuum oil having a carbon content of 3.2 per cent. During most of the remainder of the winter it was operated on residuum oil, although test runs were made with other oils. Plant operating data accumulated over these winter months are summarized in Table 1.

Short production runs with the long shutdown periods and the consequent heat losses tend to show high figures for heating oil.

A comparison of results with the first 4 shell machine in Baltimore is found

Presented at AGA Production and Chemical Conference, New York, 1951.

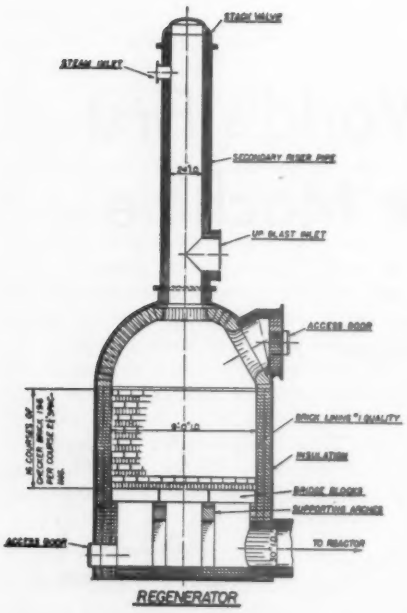



Fig. 2.

in Table 2. All shells in both machines are 11 feet in diameter.

Table 2

| | *4-shell Baltimore* | *3-shell Po'keepsie* |
|---|---|---|
| Conradson carbon | 3.16 | 3.2 |
| Specific gravity of gas | 0.866 | 0.864 |
| Gals. heat oil per Mcf* | 0.80 | 1.90 |
| Gals. make oil per Mcf* | 11.46 | 10.61 |
| Gals. total oil per Mcf* | 12.26 | 12.51 |
| Gas made per hour, Mcf* | 212 | 180 |
| Gas made per shell per hour, Mcf* | 53 | 60 |

*1000 Btu basis.

Tables 3 and 4 give further statistical data and detailed operating results for this machine.

No accumulations of carbon or other deposits were found in the machine or in the wash box at any time during the winter, and no removal of carbon manually or by scurfing or by special blasting was necessary. Indications were that this machine would run continuously for days and probably weeks without the necessity of a shutdown because of conditions within the machine. Smoke was of little consequence, and disappeared from the stacks when the machine reached thermal balance after starting up and the burners were properly adjusted.

Oils with carbon content up to 5.3 per cent have been tested on this machine. It appears at this time that economic factors do not favor use of high carbon oils at the Poughkeepsie plant. However, experience with and results from this reverse flow regenerative machine point to successful achievement with oils of considerably higher carbon content than 5.3 per cent.

Table 3

RESIDUUM OIL USED FOR HIGH BTU OIL GAS PRODUCTION

11′ x 11′ x 11′ Machine

Poughkeepsie, N. Y.

| | 1950 *October* | *November* | *December* | *Total* | 1951 *January* |
|---|---|---|---|---|---|
| A. Oil gas made, | | | | | |
| 1. Mcf | 7,200 | 15,066 | 23,939 | 46,205 | 19,054 |
| 2. Btu of gas | 992 | 1,090 | 1,096 | — | 1,070 |
| B. Gallons, oil used: | | | | | |
| 1. Heat oil | | | | | |
| a. Warming up | 2,282 | 3,313 | 7,403 | 12,998 | 4,513 |
| b. Running | 15,062 | 26,781 | 43,918 | 85,761 | 30,035 |
| c. Total | 17,344 | 30,094 | 51,321 | 98,759 | 34,548 |
| 2. Make oil | 80,484 | 164,303 | 288,009 | 532,796 | 228,483 |
| 3. Total oil | 97,828 | 194,397 | 339,330* | 631,555 | 263,031† |
| C. Gallons oil per Mcf actual: | | | | | |
| 1. Heat oil | | | | | |
| a. Warming up | .32 | .22 | .31 | .28 | .23 |
| b. Running | 2.09 | 1.78 | 1.83 | 1.86 | 1.58 |
| c. Total | 2.41 | 2.00 | 2.14 | 2.14 | 1.81 |
| 2. Make oil | 11.18 | 10.90 | 12.03 | 11.53 | 11.99 |
| 3. Total (1b + 2) | 13.27 | 12.68 | 13.86 | 13.39 | 13.57 |
| 4. Total (including 1a) | 13.59 | 12.90 | 14.17 | 13.67 | 13.80 |
| D. Total gallons oil per Mcf, 1000 Btu basis: | | | | | |
| 1. Including warming up | 13.70 | 11.83 | 12.93 | — | 12.90 |
| 2. Excluding warming up | 13.38 | 11.63 | 12.65 | — | 12.68 |

*Includes 162,193 gallons gas oil.
†Gas Oil: Residuum Oil; and 2 kinds of Bunker C Oil used; also 9′ set used part of time.

All oil gas required for peak shaving and emergencies during the winter of 1950-51 was made on the 11′ reverse flow regenerative machine, with the exception of gas made on other machines for testing the equipment and training personnel. Experience with the 11′ machine indicates that it can be continuously operated for an indefinite period.

## Description of Machine

The machine as shown in Fig. 1 consists basically of the three shells and wash box of a conventional carburetted water gas machine originally installed in 1929. The carburetter was increased to the height of the superheater and the main riser was connected to the bottom of the superheater. A secondary riser from the top of the generator was installed. Old crossovers between the shells were removed and new crossovers installed from the bottom of the generator to the bottom of the carburetter, and from the top of the carburetter to the top of the superheater. The three shells were rechristened the regenerator, the reactor, and the fixing chamber, and will be so referred to. A burner box 36″ in diameter and 36″ long was installed just above the orifice of the reactor. A steam atomizing oil burner was installed in the center of the burner box and a burner air line was connected to supply air tangentally to the box. Two oil valves were installed with the burner; one to operate at a higher rate on the heat input part of the cycle, and the other to operate at a lower rate on the inert purge and the back blast part of the cycle with certain oils and operating cycles.

The up-steam connection was relocated to supply steam to the secondary riser just below the cap. The make oil connection was attached to the top of the reactor using a steam atomizing nozzle. It may be operated either with or without steam.

A 6-point strip chart recording pyrometer was installed with chromelalumel thermocouples to give temperature read-

Table 4

OPERATING RESULTS AND CAPACITY OF 11′ MACHINE WITH RESIDUUM OIL

Poughkeepsie, N. Y.

| *February* | *Kind Oil* | *Hrs. Run* | *Gas Made* | *Btu* | *Hourly Capacity, Mcf* *Actual* | *1000 Btu* |
|---|---|---|---|---|---|---|
| 8 | Residuum | 5.8 \| 18.6 | 3189.2 | 1087 | 171.5 | 186.4 |
| | Gas oil | 12.8 \| | | | | |
| 9 | Residuum | 22.9 | 3913.5 | 1087 | 170.9 | 185.8 |
| 10 | Residuum | 10.3 | 1631.5 | 1092 | 158.4 | 173.0 |
| 11 | Residuum | 3.8 | 675.6 | 1047 | 177.8 | 186.2 |
| | | | | | Average | 182.9 |

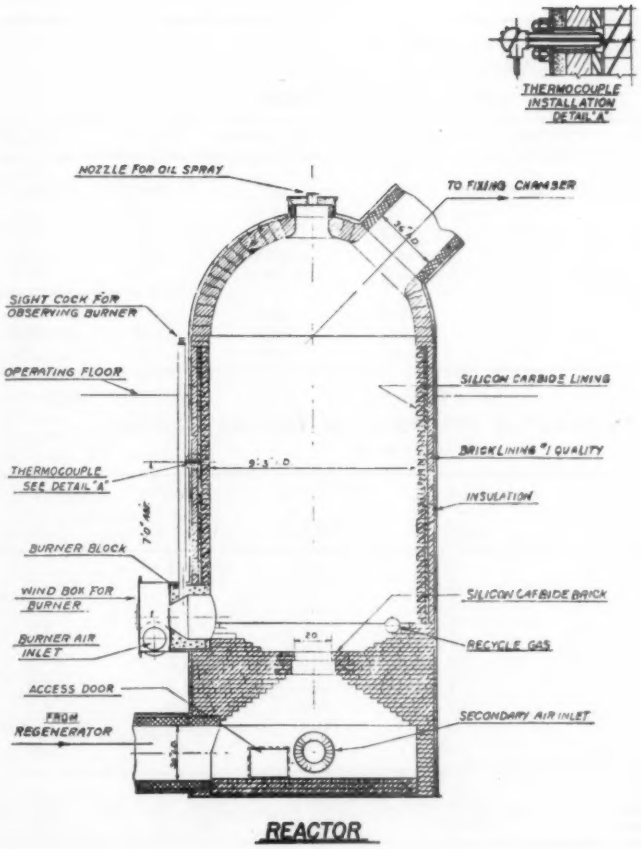



Fig. 3.

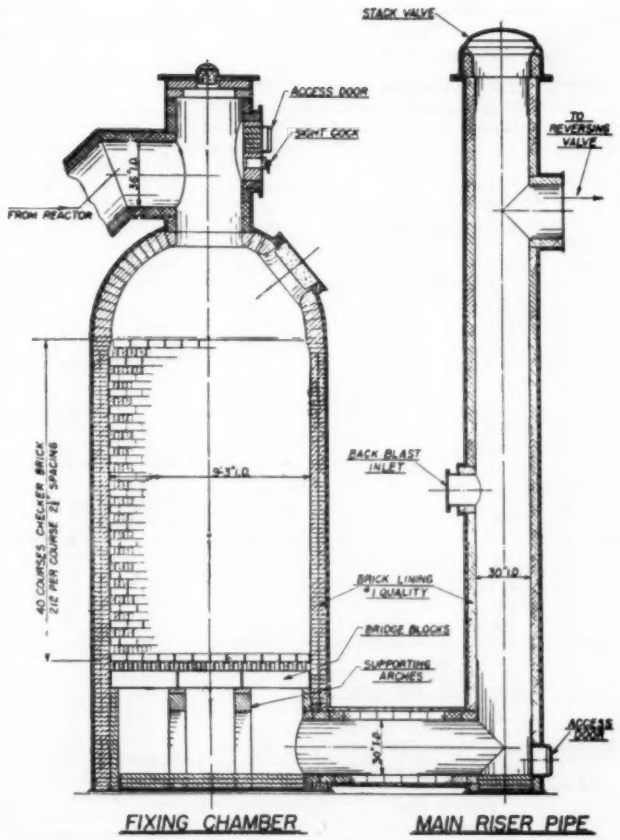



Fig. 4.

ings at the thermocouple locations shown on the diagram at the top of Fig. 1.

The general arrangement of equipment and some details of construction with measurements are shown for the regenerator, the reactor, and the fixing chamber, in Figures 2, 3 and 4.

### 1. Forward Blast

The main riser stack valve is opened as in Fig. 5 sketch below. The burner air valve and the low flow heat oil valve are opened. The up air valve is opened to the secondary riser pipe admitting air to the regenerator where it is preheated before entering the base of the reactor. The high flow heat oil valve is then opened. At the end of the forward blast period, the low flow heat oil valve, burner air valve, high flow heat oil valve, up air valve, and main riser stack valve are closed.

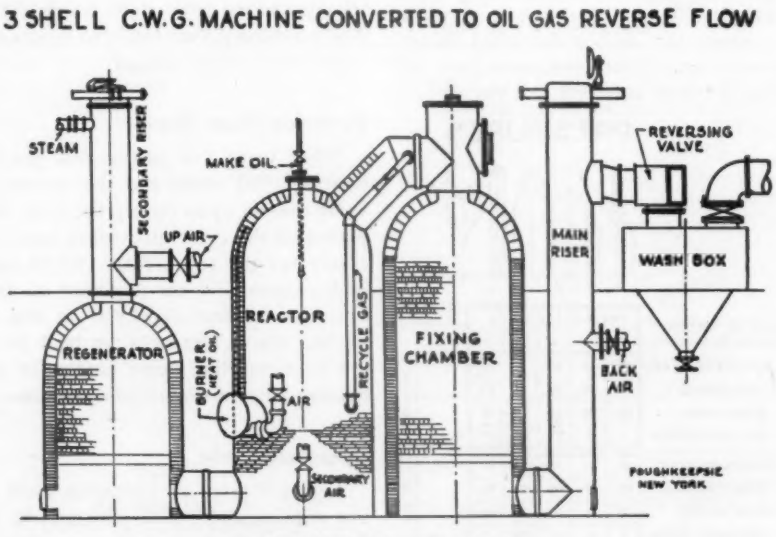

3 SHELL C.W.G. MACHINE CONVERTED TO OIL GAS REVERSE FLOW
STEAM
SECONDARY RISER
MAKE OIL
UP AIR
REACTOR
REGENERATOR
BURNER (HEAT ON)
AIR
RECYCLE GAS
FIXING CHAMBER
SECONDARY AIR
REVERSING VALVE
MAIN RISER
WASH BOX
BACK AIR
POUGHKEEPSIE NEW YORK
OPERATING CYCLE
APPROXIMATELY 4 MINUTES ARE USED FOR THE COMPLETE REGENERATIVE CYCLE. A TYPICAL CYCLE CONSISTS OF 55 SECONDS FORWARD BLAST (24%); 127 SECONDS MAKE (55%); 13 SECONDS BLAST PURGE (6%); AND 36 SECONDS BACK BLAST (15%). THE SEQUENCE IN THE CYCLE MAY BE DEVIDED INTO FOUR STEPS:-

Fig. 5.

### 2. Make

The steam valve is opened to the secondary riser pipe admitting steam to the regenerator at a low rate where it is superheated before entering the base of the reactor. The make oil valve is opened, and the resultant gas leaves the main riser pipe through the reversing valve to the wash box. Carbon formed during this period may be deposited on the wall of the reactor and on the checkers in the fixing chamber. At the conclusion of make oil input, the make oil valve is closed, the low rate steam valve closes, and high rate steam valve opens, sweeping the machine clear.

### 3. Inert Purge

The main steam valve is closed; the burner air valve and the low flow heat oil valve are opened during the inert purge period. Gas produced during the period

Table 5
AIR, STEAM AND OIL RATES
11-Foot Oil Gas Machine
Poughkeepsie Gas Works

| | | |
|---|---|---|
| I. *Air* | | *Cu.Ft./Min.* |
| | A. Up Blast | |
| 1. Burner | | 6,000 |
| 2. Secondary | | 1,400 |
| 3. Regenerator | | 18,000 |
| | | 25,400 |
| | B. Back Blast | |
| 1. Riser | | 8,500 |
| 2. Burner | | 6,000 |
| 3. Secondary | | 1,400 |
| | | 15,900 |
| | C. Inert Purge | |
| 1. Burner | | 6,000 |
| 2. Secondary | | 1,400 |
| II. *Steam* | | *Lbs./Min.* |
| 1. Make | | 250 |
| 2. Purge | | 300 |
| III. *Oil* | | *Gals./Min.* |
| 1. Make | | 100 |
| 2. Heat Oil | | |
| a. Up | | 12 |
| b. Back | | 2.5 |

Table 7
ANALYSIS OF OIL GAS
(Residuum Oil)
Representative Analysis of Oil Gas Before and After Conditioning

| | *Inlet to Low Pressure Holder* | *Gas after Conditioning* |
|---|---|---|
| | (11-28-50) | |
| $CO_2$ | 3.1 | 2.6 |
| Ill. | 33.9 | 31.5 |
| $O_2$ | 1.2 | 1.3 |
| CO | 2.0 | 2.3 |
| $H_2$ | 13.7 | 13.6 |
| $CH_4$ | 26.3 | 27.2 |
| $C_2H_6$ | 3.5 | 3.3 |
| $N_2$ | 16.3 | 18.2 |
| Btu | 1105 | 1006 |
| SG | .90 | .84 |

Note: Conditioning the gas consists in compressing it to 50 to 80 psig., cooling it, and oil scrubbing it in a bubble cap type oil scrubber tower.

Table 6
ANALYSIS OF OIL GAS
Inlet to the Low Pressure Holder

| | 10/17/50 | 11/28/50 | 12/1/50 | 12/4/50 | 1/4/51 | 2/15/51 |
|---|---|---|---|---|---|---|
| $CO_2$ | 3.3 | 3.1 | 3.1 | 3.2 | 2.8 | 3.1 |
| Ill. | 29.7 | 33.9 | 32.1 | 30.1 | 29.6 | 29.3 |
| $O_2$ | 1.2 | 1.2 | 1.3 | 1.1 | 0.9 | 0.6 |
| CO | 2.3 | 2.0 | 1.9 | 2.0 | 3.1 | 3.9 |
| $H_2$ | 15.1 | 13.7 | 14.4 | 15.9 | 15.3 | 14.8 |
| $CH_4$ | 28.4 | 26.3 | 26.9 | 29.6 | 28.7 | 26.7 |
| $C_2H_6$ | 2.6 | 3.5 | 3.5 | 2.3 | 4.7 | 2.9 |
| $N_2$ | 17.4 | 16.3 | 16.8 | 15.8 | 14.9 | 18.7 |
| Btu | 1002 | 1105 | 1104 | 1058 | 1122 | 1046 |
| SG | .81 | .90 | .90 | .86 | .87 | .89 |

Table 8
EFFECT OF REACTOR TEMPERATURE ON GAS ANALYSIS
Residuum Oil

| *Temperature at Station 4** | 12/1/50 1160° *F* | 12/1/50 1285° *F* | 12/1/50 1330° *F* | 11/22/50 1450° *F* |
|---|---|---|---|---|
| $CO_2$ | 3.2 | 3.1 | 3.2 | 2.3 |
| Ill. | 34.0 | 32.1 | 30.1 | 14.1 |
| $O_2$ | 1.1 | 1.3 | 1.1 | 0.8 |
| CO | 2.1 | 1.9 | 2.0 | 3.0 |
| $H_2$ | 11.9 | 14.4 | 15.9 | 37.4 |
| $CH_4$ | 24.2 | 26.9 | 29.6 | 32.6 |
| $C_2H_6$ | 4.5 | 3.5 | 2.3 | 1.2 |
| $N_2$ | 19.0 | 16.8 | 15.8 | 8.6 |
| Btu | 1110 | 1104 | 1058 | Below 900 |
| SG | .93 | .90 | .86 | .56 |
| Temperature at Station 5: | | | | |
| a—at end of blast | 1940° F | 1990° F | 2005° F | 2170° F |
| b—at end of make | 1310° F | 1340° F | 1365° F | 1470° F |

*See detail A, Fig. 3 for location of thermocouple.

follows the same path as the make oil gas through the wash box.

### 4. Back Blast

The reversing valve is closed to the main riser pipe. The secondary riser stack valve is opened; the back air valve is opened. Any carbon deposited during the make period is then burned from the fixing chamber checkers and the wall of the reactor. The waste heat resulting from this scurfing is transferred to the checkers in the regenerator. At the conclusion of this period, the back air valve is closed; the reversing valve is opened to wash box from main riser pipe, and the secondary riser stack valve closes. The machine is then ready to repeat step number 1—forward blast.

### Variations from Above

When using low carbon oils, the low flow heat oil valve and the burner air valve remain open during the back blast period of the cycle, providing heat necessary for the regenerator. When using high carbon oils, the sequence of valve operations differs slightly from that described above, regenerative heat resulting from scurfing being ample for preheating air and superheating steam.

### Operating Cycle

Figure 5 gives an operating cycle using residuum oil. The diagram in the figure is to facilitate following through the cycle. However, the cycle was varied from time to time and modified to accommodate different oils used for test purposes and to explore possibilities of the machine's performance. The cycle

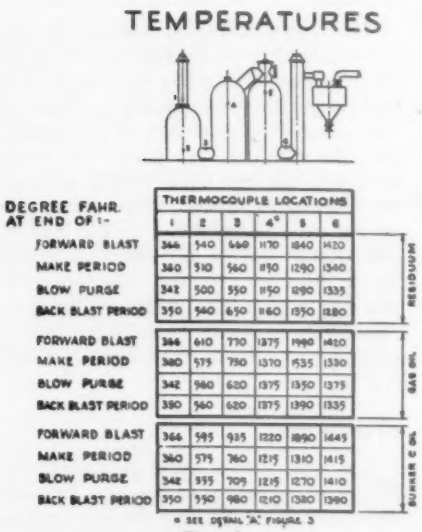


Fig. 6.

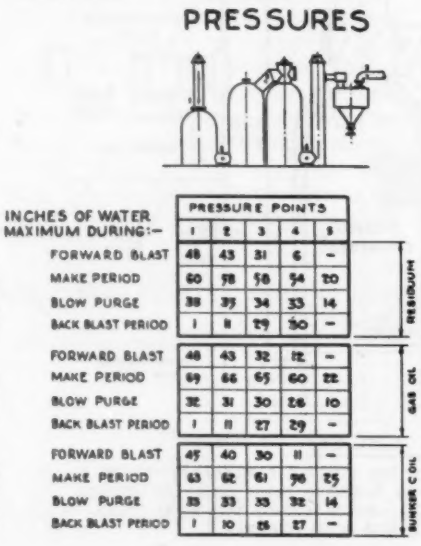

PRESSURES
INCHES OF WATER MAXIMUM DURING:-
PRESSURE POINTS
1 2 3 4 5
FORWARD BLAST 48 43 31 6 -
MAKE PERIOD 60 58 58 54 20
BLOW PURGE 38 35 34 33 14
BACK BLAST PERIOD 1 11 29 30 -
RESIDUUM
FORWARD BLAST 48 43 32 12 -
MAKE PERIOD 69 66 65 60 22
BLOW PURGE 32 31 30 28 10
BACK BLAST PERIOD 1 11 27 29 -
GAS OIL
FORWARD BLAST 45 40 30 11 -
MAKE PERIOD 63 62 61 56 25
BLOW PURGE 33 33 33 32 14
BACK BLAST PERIOD 1 10 25 27 -
BURNER C OIL
Fig. 7.

Table 9

ANALYSIS OF POUGHKEEPSIE OIL GAS

(Reported by Consolidated Engineering Corporation)

| | (Samples Collected on October 20, 1950) | | | | (Samples Collected on November 16, 1950) | | |
|---|---|---|---|---|---|---|---|
| | *Sample No. 2* Gas from Inlet to Seaboard Scrubber | *Sample No. 3* Gas Leaving Small Compressor at 100 psi* | *Sample No. 5* Gas after Heat Exchanger | *Sample No. 4* Gas Leaving Wash Oil Scrubber after Compression to 70 psi† | *Sample No. 1* Inlet to Seaboard Scrubber (before compression) | *Sample No. 2* Outlet to Compressor (100 psi at 70° F.) | *Sample No. 3* After Heat Exchanger |
| | *A* | *B* | *C* | *D* | *E* | *F* | *G* |
| Methane | 30.0 | 29.6 | 31.1 | 29.4 | 28.8 | 31.0 | 29.2 |
| Ethane | 2.5 | 2.5 | 2.4 | 2.2 | 3.1 | 2.8 | 2.9 |
| Ethene | 21.0 | 20.3 | 21.6 | 19.0 | 22.6 | 22.1 | 22.0 |
| Acetylene | — | — | — | — | 0.1 | 0.3 | 0.1 |
| Propane | 0.2 | 0.2 | 0.2 | 0.2 | — | — | — |
| Propene | 3.7 | 3.6 | 3.4 | 3.1 | 5.4 | 4.4 | 5.1 |
| Butanes | — | — | — | — | 0.1 | — | — |
| Butenes | — | — | — | — | 0.9 | 0.5 | 0.7 |
| M/e 54‡ | — | — | — | — | 0.9 | 0.7 | 0.8 |
| Vinyl acetylene | — | — | — | — | 1.8 | 0.4 | 0.8 |
| Methyle acetylene | — | — | — | — | 0.5 | 0.4 | 0.5 |
| M/e 66 | — | — | — | — | 0.4 | 0.2 | 0.4 |
| M/3 68 | 0.1 | 0.1 | 0.1 | 0.1 | Trace | Trace | Trace |
| Benzene | 2.1 | 0.7 | 1.7 | 0.5 | 3.5 | 0.6 | 1.4 |
| Toluene | 0.2 | 0.05 | 0.1 | 0.01 | 1.1 | 0.04 | 0.2 |
| Hydrogen | 20.3 | 23.0 | 17.8 | 23.5 | 15.6 | 16.9 | 15.9 |
| Nitrogen | 12.0 | 13.5 | 15.9 | 15.5 | 11.0 | 14.5 | 14.7 |
| Oxygen | 0.7 | 0.8 | 0.7 | 0.6 | 0.2 | 0.6 | 0.5 |
| Carbon monoxide | 5.0 | 3.6 | 2.9 | 3.7 | 2.3 | 2.5 | 2.7 |
| Carbon dioxide | 2.2 | 2.1 | 2.1 | 2.2 | 1.7 | 2.1 | 2.1 |
| Hydrogen sulphide | — | — | — | — | Trace | 0.01 | — |
| Water | 0.2 | 0.7 | 0.9 | 0.1 | 3.5 | 0.4 | 0.6 |

*Source of gas compressed same as for No. 2.
†Compressor fed with gas from million cubic foot holder.
‡Includes the butadienes and butynes.

Table 10

ANALYSIS OF NATURAL GAS

Received by Central Hudson Gas & Electric Corporation

| | |
|---|---|
| Methane | 92.53% |
| Ethane | 4.49% |
| Propane | 1.09% |
| Iso-Butane | 0.11% |
| N-Butane | 0.15% |
| Iso-Pentane | 0.06% |
| N-Pentane | 0.03% |
| Hexanes | 0.05% |
| Heptanes and Heavier | 0.03% |
| Carbon Dioxide | 1.20% |
| Nitrogen | 0.26% |
| Specific Gravity | 0.6086 |
| Total Heat Value | 1042 Btu. |

Table 11

ANALYSIS OF POUGHKEEPSIE OIL GAS TAR

| | *Dec.* 27, | *Jan.* 4, | *Feb.*16, |
|---|---|---|---|
| Date sampled: | 1950 | 1951 | 1951 |
| Kind of oil tar made from | Residuum | Bunker C | Several |
| Conradson carbon of oil used | 3.2% | 5.3% | — |
| Moisture content of tar | 54.5% | 54.7% | 31.2% |
| **TAR ANALYSIS—DRY BASIS** | | | |
| Specific gravity at 15.5° C | 1.111 | 1.155 | 1.163 |
| 15.5° C | | | |
| Free carbon (benzol extraction) | 12.3% | 10.4% | 11.2% |
| Unsulphonated residue: Up to 330° C | 7.2% | 8.0% | 5.6% |
| (Per cent by volume) 330—350° C | 3.8% | 1.7% | 1.2% |
| *Distillation* | | | |
| Dry basis—Per cent by weight | | | |
| Up to 170° C | 0.0% | 1.8% | 0.4% |
| Up to 235° C | 0.8 | 13.8 | 6.1 |
| Up to 270° C | 7.9 | 25.8 | 16.5 |
| Up to 300° C | 16.7 | 37.6 | 25.9 |
| Up to 350° C | 32.6 | 41.5 | 35.5 |
| Residue above 350° C | 67.4 | 58.5 | 64.5 |
| *Heating value* M Btu per gallon | 165.0 | — | — |

Tars in columns 1 and 2 were made on 11′ oil gas machine; and samples were collected to be representative of total tar production.

Table 12

APPROXIMATE COST OF CONVERSIONS

Water Gas Sets to Oil Gas Machines

| | *Location* | *Set* | *Conversion Type* | *Approximate Cost* |
|---|---|---|---|---|
| 1. | Poughkeepsie | 12′ mechanical generator set | Solid and liquid fuel | $ 15,000. |
| 2. | Poughkeepsie | 11′ x 11′ x 11′ | Semet-Solvay reverse flow regenerative | $ 68,000. |
| 3. | Poughkeepsie | 9′ set | Poughkeepsie process | $ 10,000. |
| 4. | Poughkeepsie | 8′6″ set | Poughkeepsie process | $ 8,000. |
| 5. | Kingston | 8′ set | Poughkeepsie process | $ 8,000. |
| 6. | Kingston | 7′6″ set | Central Hudson process | $ 8,000. |
| | | | | $117,000. |

Table 13

ANALYSES OF OIL USED TO MAKE HIGH BTU OIL GAS WITH 11 FOOT WATER GAS MACHINE

Converted to Reverse Flow Regenerative Operation, Poughkeepsie, N. Y.

| | *Residuum Oil* 2/23/50 | *Bunker C Oil* 12/13/50 |
|---|---|---|
| Color | Black | Black |
| Specific gravity @ 60° F | .9272 | .9547 |
| A.P.I. gravity @ 60° F | 21.14° | 16.67° |
| Viscosity, Saybolt furol @ 122° F | 28 sec. | 153 sec. |
| Conradson carbon | 3.2 | 5.3% |
| Sulphur | 0.73% | 1.89% |
| Pour point | 10° F | 40° F |
| Distillation test | | |
| I.B.P | 482° F | 536° F |
| 500–550 | 5.0% | 1.0% |
| 550–600 | 6.0 | 4.0 |
| 600–650 | 10.0 | 8.0 |
| 650–700 | 22.0 | 23.0 |
| End Point | Cracked at 686° F | Cracked at 672° F |
| Laboratory cracking test | | |
| Gas enriching value in Btu's per gallon | | |
| @ 1400° F | 102,500 | 98,300 |
| @ 1500° F | 103,000 | 100,100 |
| @ 1600° F | 104,900 | 99,100 |
| @ 1700° F | 104,100 | 94,900 |

cited in Figure 5 is representative and subject to considerable flexibility.

### Temperatures and Pressures

Representative temperature data for three kinds of oil are shown in Figure 6. These temperatures are subject to definite control and may be varied according to the nature of the oil and the desired characteristics of the gas.

Figure 7 shows pressures commonly experienced with different oils used. These pressures are not coordinated with prevailing capacities. They serve to indicate in general blower capacities required, steam pressures which should be available, and the back pressure to be expected on the machine in situations similar to that where these data were collected.

Rates of air, steam, and oil are shown in Table 5. These rates are typical of operations with residuum oil and are subject to considerable variation, depending upon the production rate and the characteristics of the gas being produced.

### Oil Gas Made

Analyses of gas with the plant's modified Burrell instrument are shown in Tables 6, 7, and 8, while Table 9 gives mass spectrometer analyses by Consolidated Engineering Corporation. The composition of the natural gas with which this oil gas is mixed or which it may supersede is shown in Table 10. Interchangeability of the oil gas with natural gas was found to be high, particularly after conditioning by oil scrubbing after the gas was compressed to somewhere between 50 and 80 psig.

### Tar Production

The quantity of tar produced was not measured with sufficient plant accuracy to be recorded here. Distillation was not required for dehydrating. The tar separated from the water by standing in a warm wet storage tank, and handled and decanted as well as or better than carburetted water gas tar made from the same oil. Table 11 shows the analyses of the tar produced in manufacturing high Btu oil gas from residuum oil and Bunker C oil. Also, the analysis of a composite tar from several oils used is shown in the last column of the table.

### Cost of Conversion

Table 12 gives the approximate total capital cost of converting the six carburetted water gas sets to high Btu oil gas machines.

## GAS HOLDER PLAYS MAGPIE FOR 39 YEARS

Recently, Public Service Company of Northern Illinois made a complete inspection of its Skokie gas holder. After 39 years of service, the holder was given conventional inspection and repair work. The picture shows some of the debris found at the bottom of the holder. Many tools were found, and it is believed that they were dropped by the workers installing the crown plates when the holder was built. A kerosene lamp which had been under water for 39 years was lighted easily.

# Higher Court Decisions Cover Matters Of Interest to Utilities

by Leo T. Parker

Attorney at Law, Cincinnati

RATES, franchises, city ordinances and legality of allocation of gas are important subjects today. Also, under what circumstances may a gas corporation which sells and distributes gas in a state or city avoid the Natural Gas Act and not be affected by orders of the Federal Power Commission? What arguments usually are presented by a gas corporation which desires to be within the control of the Natural Gas Act with respect to local transactions?

According to a late higher court decision, neither the Natural Gas Act which regulates the transportation and sale of natural gas nor orders of the Federal Power Commission pertaining to natural gas are applicable to intrastate or local distribution of natural gas by a local gas company.

Therefore, irrespective of desires of officials of a gas corporation, which transacts intrastate business, the corporation cannot rely upon rules, regulations and orders issued by the Federal Power Commission notwithstanding the same are issued under the apparent authority of the Natural Gas Act.

For example, in Peoples' Gas & Electric Company v. Herme, 46 N. W. (2d) 551, the testimony showed facts as follows: The Peoples' Gas & Electric Company is a public utility company which serves a city with gas. A franchise was granted to the company by the city council, was approved at a special election and accepted by the company. Under this franchise the company furnished natural gas for general use, space heating, and for commercial and industrial purposes.

One Herme operates a garage in the city and on March 19, 1948 made application to the company for gas service for his building and garage. At the time of this application Herme is claimed to have made the statement that the gas service was wanted for a water heater. Some time prior to December 16, 1948, Herme, without the knowledge or consent of the gas company, made a connection to the service line in his building and attached it to facilities for space heating. When this fact was discovered by representatives of the gas company, Herme was informed that since December 30, 1946 natural gas for heating purposes had been restricted, that new installations had not been permitted except under limited conditions, that the company was not taking on any commercial heating or installations for heating of new homes and that the space heating which was being made use of by Herme would have to be discontinued and the connections made for that purpose disconnected. No application had ever been made to the gas company for space heating of the garage. Herme refused to disconnect the installation for heating purposes, and a law suit resulted.

## Council Approval

During the trial Herme proved that the gas company's franchise authorized making of necessary rules and regulations but provided that such rules and regulations *must be approved* by city council before being placed in force. Also, Herme proved that the above mentioned gas allocation rule never had been approved by the city council. Herme's counsel contended that the gas allocation rule is invalid and unenforceable because this rule, not having been approved by the city's council, is without any legal effect.

The gas company's counsel argued that the allocation rule is valid because an order of the Federal Power Commission was made under the authority of the Natural Gas Act, that the allocation of the gas by the gas company to the inhabitants of the cities and towns, which it served, had to comply with the orders and regulations of the Federal Power Commission and that the right of the gas company to allocate the gas received by it is derived from the Federal Power Commission to regulate commerce between the states; (2) that the franchise ordinance does not require the gas company to furnish the full requirements of the communities served under the conditions shown; (3) that the gas company was given authority under the franchise to make all necessary rules and regulations with respect to supplying gas to the city and its inhabitants, and the fact that the ordinance provides such rules must first be approved by the city council does not limit or restrict the power to make such rules nor does it make them void if they are fair and reasonable; (4) that the rules and regulations under which allocations of gas were made by the gas company were not such rules and regulations as were contemplated by the ordinance requiring them to be first approved by the city council; (5) and that the gas company had the power under the common law to make and enforce such rules and regulations as are necessary in the operation of its business provided they are reasonable, fair and without discrimination.

Notwithstanding this argument the higher court held the gas company must furnish gas to Herme for heating purposes. The court said:

"We do not believe that the Natural Gas Act and the orders of the Federal Power Commission have any jurisdiction over the local distribution of natural gas by a local utility. It is our conclusion that there can be no question but that the local distribution of natural gas in Mason City did not come within the provisions of the Natural Gas Act and was not affected or controlled by any rules or regulations made by the Federal Power Commission."

In Federal Power Commission v. Panhandle Eastern Pipeline Company, 337 U. S. 498, the Supreme Court quoted:

"The Act, moreover, expressly exempts from its coverage (1) any other transportation or sale of natural gas; (2) the local distribution of natural gas; (3) the facilities used for local distribution; and (4) the production and gathering of natural gas."

On the other hand, the higher courts are in accord with the proposition that a public service commission may invoke valid and unusual rules during a period an emergency exists.

For example, see City of Akron v. Public Utilities Commission, 149 Ohio

# FPC Reports 1950 Statistics For Natural Gas Companies

Gas operating revenues of 135 natural gas companies filing annual reports with the Federal Power Commission totaled $1,459,954,000 for the year 1950. Sales of natural gas by the companies amounted to 5.67 trillion cubic feet.

A high proportion of the operating income of certain of the reporting natural gas companies is derived from other than natural gas operations. In order that developments in the natural gas industry may be observed undistorted by the effect of other utility operations, these companies have been excluded from the comparative 1950-1949 data.

Sales of natural gas and revenues from such sales reported by the predominantly natural gas companies for 1950 amounted to 5.47 trillion cu. ft. and $1,280,297,000, respectively, representing increases of 23 per cent in sales and 25.2 per cent in revenues, over sales of 4.45 trillion cu. ft. and revenues of $1,022,395,000 in 1949. Service was supplied to an average of 6,057,000 customers during 1950 compared to an average of 5,795,000 during 1949, or an increase of 4.5 per cent.

Gas operating revenue deductions including charges for operation and maintenance and provision for depreciation and taxes amounted to $1,085,519,000 for the year and in relation to revenues decreased slightly from 83.1 cents per revenue dollar in 1949 to 82.9 cents in 1950. During 1950, 63.4 cents of the revenue dollar went for operating expenses, including the cost of purchased gas, 7.8 cents for depreciation, 7 cents for federal taxes on income, and 4.7 cents for other federal, and state and local taxes.

Gas utility operating income for 1950, after providing for exploration and development costs of $7,555,000, amounted to $217,681,000 and was equivalent to 6.9 per cent of the average net investment in gas plant for the year. The comparable rate in 1949 was 6.7 per cent.

Gross income of the companies, including income of $1,162,000 from utility operations other than gas and $15,583,000 non-operating income, amounted to $234,426,000 for 1950. Income deductions aggregated $51,696,000 for the year. The net credit of $8,421,000 shown for other income deductions reflects interest charged to construction during the year. Interest on long-term debt, amounting to $54,224,000 for the year, was earned 4.3 times.

Net income of the companies for 1950 amounted to $182,730,000, representing an increase of 29.8 per cent over the $140,745,000 reported for 1949.

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St. 347. In this case the one question considered by the court was whether the state public service commission had authority to adopt emergency rules and regulations which in effect suspend for a limited period the terms of a contract entered into by a municipality and a public utility for gas to be furnished to the residents of the city. It was there held that the public service commission could make such an order.

### What Is Franchise?

Considerable discussion has arisen from time to time over the question: "What is a legal franchise? Also, is a contract by which a city agrees to purchase gas from a named individual or company, a franchise?"

According to a late higher court decision, a contract to purchase gas exclusively from an individual or company is not a franchise. Hence, such a contract is not void as being in violation of a constitutional provision or state law which requires a gas company, or other, to have a franchise.

The higher courts hold that the term "franchise" is difficult to define due to the broad sense in which it is used both in legal and popular parlance. But it seems certain that it is a grant of a right to use public property, or at least the property over which the granting authority has control.

For example, in Young v. City of Morehead, 233 S. W. (2d) 978, the court records disclose these facts: On February 27, 1936 one Young and a city entered into a written contract whereby he (Young) agreed to furnish natural gas at certain pressure and prices to the city at its corporate limits for ten years from the date of the contract, with the option to Young of extending the contract for ten additional years by giving the city written notice at least thirty days before the expiration of the first term of his intention to extend the contract. While the contract does not so state, the record shows the city owns a gas distribution system and in a proprietary capacity was furnishing its inhabitants the gas it purchased from Young. It is provided in the contract that the city was to purchase gas *exclusively* from Young unless he was unable to furnish an adequate supply, in which event it might purchase from other sources after taking all gas Young could supply.

After purchasing gas from Young for 13 years, the city officials filed suit and asked the court to declare void the contract made in 1936 with Young, on the grounds that, first, the city did not advertise publicly the sale of a franchise to the highest and best bidder; second, that Young never obtained a franchise and his contract is in violation of the state's constitution; and third, Young never had a franchise issued by the county to lay his gas pipes in the county.

The higher court refused to hold the contract void, saying:

"Whether or not Young had a county franchise was immaterial to his or the city's rights under the contract. The contract for the sale and delivery of gas by Young into the city's distribution system at its corporate limits did not grant him a franchise. The right to produce and sell gas is not a prerogative of a government but is a business open to all; therefore, Young was not exercising a franchise when he contracted to sell and deliver his gas to the city at its corporate limits. Had the contract authorized him to use public property under the city's control, we would have a different question."

For comparison, see Willis v. Boyd, 7 S. W. (2d) 216. Here a county granted one Boyd a 50 year privilege to use county property. The court held the contract void because the county had permitted the use of public property without selling a franchise to the highest and best bidder after due advertisement.

### Rate Classifications Held Valid

According to a late higher court decision, a rate schedule and regulation is valid under which industrial gas consumers can pay higher rates for guaranteed uninterrupted service.

For example, in State v. Oklahoma Natural Gas Company, 227 Pac. (2d) 666, the testimony showed facts as follows: The Oklahoma Natural Gas Company is a public utility engaged in the sale and distribution of natural gas. Prior to July 9, 1949, there was in force within the state, what is known as "rate schedule I-1." This is a rate schedule set up in an order of the corporation commission fixing the rate for the sale of gas to industrial consumers, and prescribing regulations appliable to the furnishing of industrial gas service. Industrial consumers are defined as those whose primary business is the manufacture or the processing of a product for sale to the public. Under rate schedule I-1 contract service to industrial consumers may be interrupted or discontinued without notice when the supply of gas is inadequate to meet the demands of the gas corporation's other customers.

By order of July 9, 1949, the corpora-

*(Continued on page 39)*

# Index of Yields : Selected Utilities Stocks

| | July 1951 | June 1951 | May 1951 | Apr. 1951 | Mar. 1951 | Feb. 1951 | Jan. 1951 | Dec. 1950 | Nov. 1950 | Oct. 1950 | Sept. 1950 | Aug. 1950 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Natural Gas Transmission Companies | 5.07% | 5.26% | 5.35% | 5.22% | 5.38% | 5.31% | 5.36% | 5.97% | 5.62% | 5.19% | 5.71% | 5.46% |
| Natural Gas Transmission & Distribution Companies | 5.24 | 5.30 | 5.45 | 5.43 | 5.35 | 5.31 | 5.47 | 5.67 | 5.46 | 5.40 | 5.61 | 5.71 |
| Manufactured & Mixed Gas Companies | 5.52 | 5.22 | 5.35 | 5.23 | 5.22 | 5.21 | 5.22 | 5.56 | 5.46 | 5.24 | 5.52 | 5.55 |
| Class "A" Electric Companies | 5.97 | 5.95 | 5.88 | 5.52 | 5.49 | 5.65 | 5.62 | 6.19 | 6.03 | 5.56 | 5.67 | 5.59 |
| Class "B" Electric Companies | 5.86 | 5.88 | 5.94 | 5.72 | 5.66 | 5.78 | 5.80 | 6.38 | 6.06 | 5.99 | 6.06 | 6.35 |

**Method of Compiling Index of Yields**

This is a straight arithmetical index of comparative yields obtainable on a selected group of gas and electric utility industry common stocks.

The companies comprising this index have been selected by the AMERICAN GAS JOURNAL as providing a representative cross-section of each industry, from the standpoint of geographical diversification and of the relative importance of the individual companies in their areas.

No effort has been made to weight the average to give effect to changes in capitalization or in dividend rates because the yields afforded on the issues reflect such changes. The index is designed to show the rate of return and not necessarily market movements on the stocks comprising it.

The companies used in compiling this index are:

Natural Gas Transmission Companies: El Paso Natural Gas Co.; Northern Natural Gas Co.; Panhandle Eastern Pipe Line Co.; Southern Natural Gas Co.; Tennessee Gas Transmission Co.

Natural Gas Transmission and Distribution Companies: Columbia Gas System, Inc.; Consolidated Natural Gas Co.; Lone Star Gas Co.; Oklahoma Natural Gas Co.; Pacific Lighting Corp.

Manufactured and Mixed Gas Companies: Bridgeport Gas Light Co.; Brooklyn Union Gas Co.; United Gas Improvement Co.; Peoples Gas Light & Coke Co.

Class "A" Electric Companies: Boston Edison Co.; Commonwealth Edison Co.; Houston Lighting & Power Co.; Southern California Edison Co., Ltd.

Class "B" Electric Companies: Dayton Power & Light Co.; Hartford Electric Light Co.; Pennsylvania Power & Light Co.; Public Service Co. of Colorado; San Diego Gas & Electric Co.

John F. Falvey

RECENT improvement in the bond market represents a heartening development for gas company managements facing the necessity for further financing. Issues with an investment rating of 'A', or sound, now provide a yield of 3.46 per cent on reoffer to the public, as measured by the Washington Gas Light Company 3½'s of 1976.

This represents a fairly sizable reduction from the 3.625 per cent at which similarly rated issues were sold to the public in the latter part of June.

First grade bonds at last report were selling on the average at a 10 per cent higher yield than third grade obligations were quoted at the end of 1950. Slight though the recent improvement in market conditions has been, it nevertheless constitutes a welcome development in that the rush of inflationary forces seems to have been checked, at least for the time being.

Investment underwriting firms at this writing have practically no inventory whatever of corporate bonds, preferred or common stocks; and only a comparatively few issues have been listed for early public sale. They should meet a ready market demand.

During recent weeks there has been a considerable change in the thinking of investors and of their investment advisers in favor of public utility industry common stocks—both electric and gas. Many investment quarters cite the 'defensive characteristics' of the utilities and the recent lessening of inflation fears as the reason for this increased favor for utility equities. It is hard to reconcile this purported defensive nature of the utilities with their demonstrated vibrancy and growth, as well as with their proved ability of late to carry through to net earnings a substantial proportion of revenue gains, despite continuing heavy increase in taxes and in the cost of practically everything going into the business.

In their improving market action during recent months utility equities have not been aided by any substantial amount of buying by life insurance companies (AMERICAN GAS JOURNAL 1951) since enactment by the New York State legislature permitting life companies in the state to invest up to three per cent of their assets in common stocks. The biggest companies have not acquired a share of stock; and they say they do not propose to. All life companies are reported to hold about two billion dollars of equities of all types, against utility bond holdings alone of approximately $10.4 billion.

## All-Time Low

Dogmatic predicting of the trend of security market events to come is precluded by the unsettled world situation and by the befuddlement in everything labeled 'official Washington.' But several factors are worth noting. All listed stocks currently are selling on an average of only about nine times their combined 1950 earnings. This is an all-time low times-earnings ratio for the period for which such data have been compiled.

Even if corporate profits should decline as much as 20 per cent this year, compared with 1950, the times-earnings market price of corporate equities would not exceed the all-time average.

Granting that armament expenditures may slow up somewhat from their previously anticipated rate and possibly not reach their high until probably two years hence, outlays for the purpose for the balance of 1950 at a $40 to $45 billion annual rate should serve to keep industry humming on a fairly high level for several years. Relaxation of Regulations W and X on slackening of the war effort, or possibly earlier, conceivably might permit two or three additional good years for industry as it provides the consumer with goods now withheld from him under government regulation.

Another favorable straw in the wind is the likelihood that the still to be enacted Federal tax bill will be less onerous than the administration would like since this relaxation of one of the reins of inflation controls would combine with the armament expenditures to prompt renewal of stock purchases as an inflation hedge.

As pointed out in AMERICAN GAS JOURNAL in the issue of June 1951 the success of recent utility common stock offerings has been due in no small measure to the feature whereby shares sold through rights could be bought on margin by putting up cash equal to only 25 per cent of the market price, compared with 75 per cent cash required in straight stock purchases. To avoid possible misuse of this privilege the New York Stock Exchange has warned its member firms, among other things, that 'the special subscription account (of customers) should

*(Continued on page 36)*

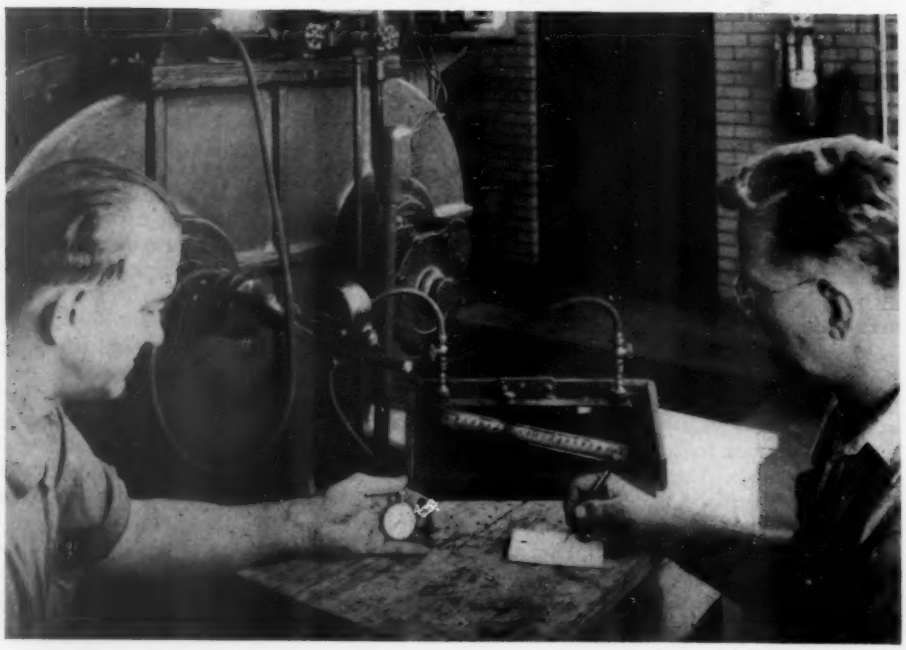
**CLEARANCE TEST**

This test consists in accurately measuring the rate at which gas flows through the meter clearances at various specified differential pressures when the meter impellers are externally driven at very slow and uniform rates of speed. This picture shows the drive unit, diaphragm meter with differential draft gauge.

Illustrations courtesy of The Philadelphia Gas Works *News*, E. M. Miller, Editor.

## With Apparatus Built by Its Meter Division

# Philadelphia Gas Works Test La



**RATE TEST**

The rate test consists in measuring the differential pressures across the meter while it is operating normally at various speeds throughout its operating range.

DISPLACEMENT TEST—To determine the displacement of one revolution of the meter: Displacement is determined by driving meter at a very slow rate of speed (equivalent to one per cent or less of its rated capacity) and maintaining a zero pressure difference across the impellers. Shown are the drive unit, reference meter, blower and indicator bag.

# Large Capacity Rotary Gas Meters

MEASURING the quantity of gas send-out of Philadelphia Gas Works Co. has become an increasingly greater problem since send-out has skyrocketed to almost unbelievable figures. To measure a portion of the send-out, large-capacity rotary gas meters are used. Proving the accuracy of these rotary meters is a formidable problem, but it was undertaken with reasonable assurance.

During the summer of 1947, the company decided to test the Connersville (rotary) meters at Stations A and B, according to the methods prescribed by the Bureau of Standards. The company also prevailed upon the Bureau of Standards to supervise the tests.

To make these tests, rather elaborate apparatus is required. This was borrowed from The Peoples Gas Light & Coke Company, Chicago, where the Bureau of Standards, working with the "Peoples of Chicago" had originated the method of test and the apparatus required. Subsequently, however, PGW decided to have its own testing apparatus. Over a period of approximately a year, ending early in 1950, men in the meter division constructed the necessary testing apparatus.

During the summer of 1950, the PGW apparatus was used to test the big meters at Stations A and B, and also at the Philadelphia Coke Company, from which organization coke oven gas is bought. Meters tested are really big. The two largest rotary meters—one located at Station A and the other at Station B—have capacities of one million cubic feet per hour.

Results of these tests indicate the accuracy of the rotary meters used to measure the millions of cubic feet of gas manufactured in production plants.

The pictures shown here, along with several others, were taken at the request of the Bureau of Standards. They were used in an exhibit during 1950 at the Appalachian Gas Measurement Short Course at West Virginia University. The PGW apparatus also was on display there.

# FPC Announces 'No Jurisdiction' Over Phillips Petroleum

CHAIRMAN Mon C. Wallgren of the Federal Power Commission announced on July 18 that the FPC had concluded in executive session that under the law and facts of record it does not have jurisdiction over the Phillips Petroleum Company as a "natural gas company." An opinion and order to this effect will be issued in due course.

Commissioner Thomas C. Buchanan stated that he will dissent.

The Commission's decision undoubtedly will be appealed to the Supreme Court, the chairman said.

### Statement by Adams

K. S. Adams, chairman, Phillips Petroleum Company, when asked to comment on the FPC ruling said:

"Needless to say, we are gratified with the decision that Phillips Petroleum Company is not subject to regulation as a natural gas company. The decision means that the commission is satisfied with its previous rulings extending over a period of eleven years that sales by independent producers and gatherers are not subject to regulation.

"This is a signal victory for producers. It is also a victory for the consuming public, though some of their representatives in these proceedings do not seem to realize it.

"When this decision becomes final, it is hoped that this will be the end of agitation, with each change in membership of the commission, to reverse previous decisions and subject independent producers and gatherers to regulation.

"An unregulated industry can and will develop far greater supplies of this premium fuel than could ever be expected through regulation. Greater supplies and free competition between gas producers and with other fuels will hold prices at reasonable levels."

### Statement by Anderson

Texas independent oil and gas producers were said to be awaiting further developments and orders to determine whether their operations are placed outside the jurisdiction of FPC.

R. B. Anderson, president of the Texas Mid-Continent Oil & Gas Association, said:

"Our association has long championed the idea that the men who take the risk of discovery and development of our gas resources should not be subjected to the utility-type regulation of the Federal Power Commission.

"It is encouraging to independent Texas producers that such a large majority of the commission membership has expressed a firm opinion that the commission does not have jurisdiction over the production and gathering of natural gas by independent producers.

"Previous overnight switches in commission policy on this question have made Texas oil and gas producers mindful of (1) the need to examine carefully the formal order and (2) to await a crystallization of policy before making long-range plans as to their gas sales.

"This ruling is the latest in a historical series of contradictory administrative policies by the commission and by court interpretation of the Natural Gas Act. It points clearly to the need for congressional action that will specifically guarantee the independent producer exemption from utility regulation in arm's length sales of natural gas or sales for resale. Otherwise the Texas independent producer will remain confused."

## New Coal Process Obtains Tar And Low-Cost Power

After nearly two years of research, the Bureau of Mines has announced a new process that offers promise of making the reserves of lignite and other low-rank non-coking coals a major source of both low-cost electric power and coal tar products.

The process was developed in the bureau's coal branch laboratories and pilot plants at the Denver Federal Center under a cooperative agreement with the Texas Power and Light Company.

Major products of the process, a variation of low-temperature carbonization, are a high heating value char suitable for power plant use and crude coal tar. The process is said to be applicable to any coal of lesser rank than high volatile bituminous B, a bracket that encompasses 90 per cent of all western coals.

If average western coal is used, the value of the tar recovered is expected to be equal to the cost of the raw coal, while more favorable coals may yield as much as 45 to 55 gallons of tar oil per ton.

According to present calculations, based on pilot plant results, profits from 14 gallons of tar recovered from a ton of Milam County, Texas, lignite would enable this fuel to compete with natural gas selling at five to eight cents a thousand cubic feet.

This fact explains the interest of the Texas Power and Light Company in sponsoring the research, since this company uses natural gas in its existing power plants.

*(Continued on page 37)*

## American Gas Fundamentals

### OUTLINE

**Natural Gas**
1. Geology
2. Drilling and Production

**Manufactured Gases**
1. Coke oven gas; producer gas, blue gas; carbureted water gas
2. Reformed gas
3. Hi-Btu oil gas

**Transmission**
1. Pipe lines
2. Corrosion and pipe protection
3. Compressor stations
4. Super compressibility
5. Hydrates and dehydration
6. Gas conditioning
7. Flow formulae
8. Orifice meter measurement

**Gas Storage**

**Gas Distribution**
1. System design and operation
2. Pressure regulation
3. Measurement and accounting

**Gas Utilization**
1. Combustion characteristics
2. Domestic
3. Commercial and industrial
4. Interchangeability

**Conversion Practices**

**Management Problems and Policies**
1. Corporate structure
2. Public utility regulation
3. Public relations

## How to Use the Material

American Gas Fundamentals *is not intended as a training or service manual. It is a comprehensive compilation of basic gas facts to guide any gas utility employee toward a broader understanding of the industry as a whole. It is written in layman's language so that the technical fundamentals of every subject treated may be digested and understood by the non-technical reader.*

*The series is designed to be removed from each current issue of* AMERICAN GAS JOURNAL *and filed in a ring binder where it may be accumulated into a text book of permanent usefulness. Since the series will not run in sequence as outlined, material should be filed under the major subject head appearing in the upper right hand box at the head of each chapter.*

*New subscribers to* AMERICAN GAS JOURNAL *will be supplied free, upon request, with reprints of all previous chapters. Younger employees who may be required to serve in the armed forces will have put aside for them a full set of all texts that may be printed during their absence.*

AMERICAN Gas FUNDAMENTALS

DISTRIBUTION
PRESSURE REGULATION

A CONTINUING EDUCATIONAL AND REFRESHER COURSE IN GAS TECHNIQUES, OPERATIONS AND MANAGEMENT

# 1. *Elements of Gas Pressure Regulators*

FACED with the problem of building or understanding a pressure regulator, the first thing you need to know is—what does a regulator have to do? The most obvious job a regulator has to do is reduce pressure. That sounds simple; any restriction in a gas line will reduce an upstream high pressure to some lower downstream pressure. But the upstream or inlet pressure never stays the same. So it must provide for changing flow conditions all the time. Cookstove and refrigerator burners are pretty choosy about the downstream or outlet pressure, so the outlet pressure must be as constant as possible. The regulator must be gentle enough to pamper the pilot on a stove. Or it must be brute enough to restrain the tremendous energy in a 24-inch 1,000 pound pressure pipe line.

The essential elements of any regulator fall into three distinct groups, according to their jobs.

First, there is the measuring element which measures the outlet pressure and may also enter actively into the working of the regulator. A glance at Fig. 1 indicates that this measuring component may be a diaphragm, bourdon tube manometer or bellows. The pressure gauge is merely one of these supplied with a case and dial.

There is second, the restricting element also shown in Fig. 1, which is always some sort of valve which can be opened or closed as necessary to increase or decrease flow.

Third, there is the loading element. This component is supposed to react to a message from the measuring element and force the restricting element to open or close to keep the outlet pressure within bounds. There is, as shown in Fig. 1, a variety of loading elements including weights, springs, pressure or direct manual, as indicated by the "small boy."

The regulator, therefore, consists of one measuring, one restricting and any number of loading elements.

Let us first build a simple regulator. A pressure gauge is a simple enough way to tell when the pressure changes. So we select the pressure gauge as the "measuring" element. A globe valve is not complicated, so we select that as the "restricting" element. Even a small boy can read a pressure gauge to detect pressure change, so you select him as the "loading" element. Put them together and we have the simple regulator shown in Fig. 2(A). Let us now put this regulator to work in a gas distribution system.

We tell the small boy what the pressure gauge is supposed to read and tell him to screw down on the valve if the pressure gets too high, or open up the valve if the pressure gets too low. But the gas may then play all sorts of tricks on him without his knowing it. Conditions may raise the upstream pressure, then increase the gas load downstream, then lower the upstream pressure, sometimes slowly, sometimes rapidly. The small boy is either too busy to keep up with the rapid changes or perhaps because of the slow changes in pressures and flows he may fail to notice that the pressure gauge reading has gradually changed.

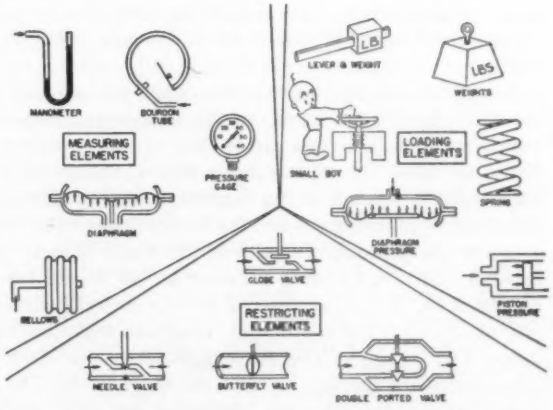



FIG. 1—ESSENTIAL ELEMENTS OF A REGULATOR.

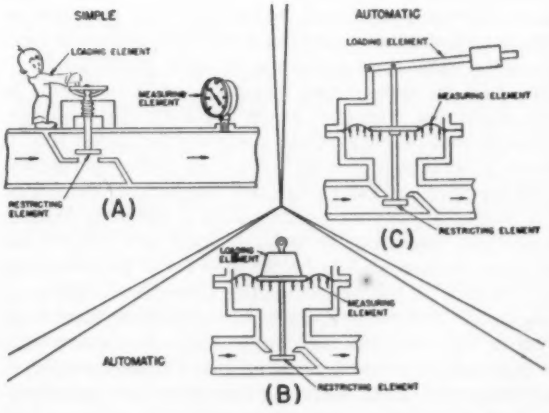



FIG. 2—BUILDING A REGULATOR.

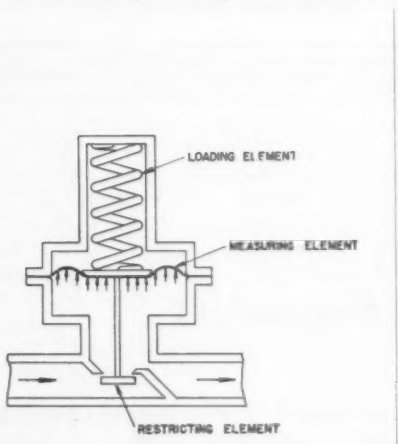



FIG. 3—SPRING LOADED REGULATOR.

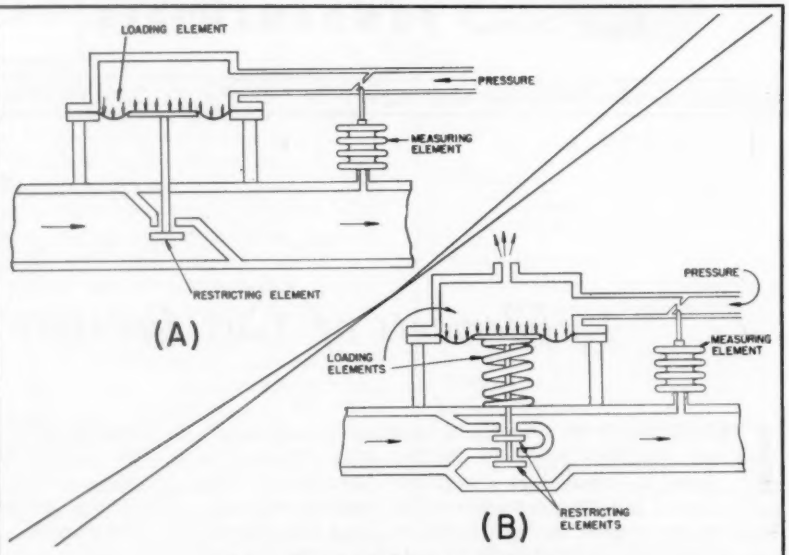



FIG. 4—IMPROVED REGULATOR.

Only so long as pressures and flows change in small definite steps will the simple regulator work fairly well. But a regulator that is manually operated has a lot of built-in error. What we want is an automatic regulator. So we decide to use something else as a loading element.

This time for the measuring element we will select the diaphragm; for the restricting element, the globe valve; and for the loading element, a dead weight. These three elements put together make the regulator shown in Fig. 2(B). If it works, we have an automatic regulator. And it does work.

Before we turn the upstream pressure on, the diaphragm measuring element doesn't feel any downstream pressure and, therefore, "tells" the weight loading element to push the restricting valve wide open, which it does. Then when the upstream pressure is turned on, gas flows through the valve and pressure begins to build up downstream. The diaphragm measures this downstream pressure as it builds up, but tells the weight to sit still until finally the downstream pressure is high enough. Then, when it is high enough, the diaphragm and weight go up and the restricting valve goes up with them, cutting off the flow of gas. With no flow of gas through the regulator, the downstream pressure falls and the measuring diaphragm tells the weight to push the valve open again and let some gas through.

But then the downstream pressure suddenly begins to go up and down. You look at the regulator. Sure enough, the weight and diaphragm are going up and down too. It looks as if the regulator were hunting for the proper downstream pressure and can't ever quite decide just where it is.

To overcome this let us introduce a different loading element that might not be so undecided as to where the restricting element should be stopped for a given rate of flow. We take off the weight loading element and put on a spring loading element instead. The regulator then is as shown in Fig. 3. It has the characteristic that every time flow increases, the downstream pressure, though steady, is somewhat lower. Then when the flow decreases, the downstream goes back up again correspondingly. The restricting element appears to have a certain position for every rate of flow and downstream pressure.

As we ask it to do a better and better job, however, and to handle a wider range of conditions, we find that it too has definite limitations. For example, as more spring force is applied to achieve a higher and higher downstream pressure, we may find that the diaphragm has ruptured and gas is blowing out. We also find that a high enough upstream pressure will hold the restricting element closed regardless of what the diaphragm tells the spring, indicating that the pressure difference across the valve is tending to close it.

Next let us attempt to select the three elements to get the advantages of all three of the previous regulators. We select as a measuring element, the bellows; as a restricting element, the globe valve; and as a loading element, diaphragm pressure, to build up the regulator in Fig. 4(A).

The theory is that the downstream pressure, as it builds up, will expand the bellows and shut off the loading pressure on the diaphragm which has been holding the restricting valve open. Then when the downstream pressure falls, the bellows will shorten and allow more pressure to flow in on the diaphragm. More pressure on the diaphragm will push the restricting valve open and the downstream pressure will come back to the desired set point. We try it out; but it doesn't work! Why not? All the essential elements are present.

Study the regulator and the theory and you see that once we have put pressure on top of the diaphragm to open the valve, we must then get rid of that pressure, before the valve can close. To relieve this pressure, therefore, put a bleed hole in the top of the diaphragm casing. The bleed hole leaks out pressure when the bellows tries to put more pressure on the diaphragm, but the bleed hole is small enough that it can't bleed pressure as fast as the bellows can let it in. So far, so good. But even though there isn't any pressure on the diaphragm, what's to make the valve close? The weight of the diaphragm, the valve stem and other parts are tending to hold the valve open. The upstream pressure against the bottom of the valve can't be depended on since it is not uniform.

A spring may be used to close the valve and to get rid of

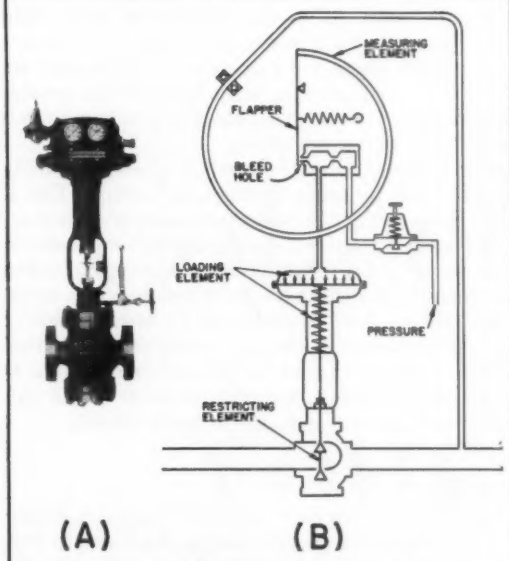



FIG. 5—COMMERCIAL VERSION.

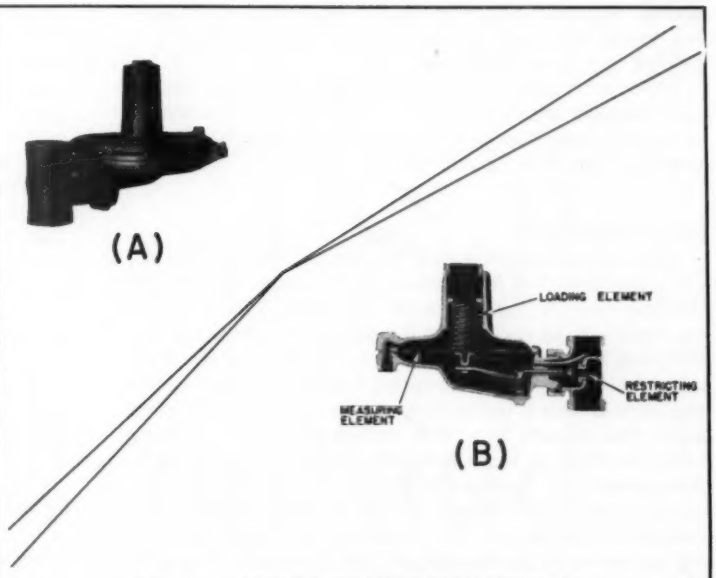



FIG. 6—ANOTHER COMMERCIAL VERSION.

the trouble with the single seated globe valve, a double ported valve used as the restricting element. In the double ported valve, the high upstream pressure tends to open and close the valve at the same time and thus balances itself out. Fig. 4(B) represents the regulator thus rebuilt. The basic theory is the same as 4(A) but with a bleed hole for the loading pressure and a spring under the diaphragm to make the regulator spring closing, and changed to a balanced type of inner valve, it works like a charm. Before the upstream gas is turned in, the bellows is short and allows pressure to build up on the diaphragm. This diaphragm pressure overcomes the spring and forces the restricting valve open so that some of the upstream gas gets through to build up downstream pressure. The bellows measures the increasing downstream pressure and gradually expands to choke off the pressure going to the diaphragm. With no more pressure being added to the diaphragm, the diaphragm pressure leaks out through the bleed hole and the spring closes the restricting element valve. Then as the downstream pressure falls, the bellows responds to cause a greater diaphragm loading pressure. The restricting valve opens a little, and the downstream pressure settles down to a steady value.

The only limitations are the flow capacity of the restricting valve and the ability of the bellows to withstand high downstream pressures. This is remedied by using whatever size of restricting valve is necessary and substituting a bourdon tube (which can take pressures up to 10,000 pounds) for the bellows. But we added a fourth element when we stuck in the spring as we did; so what has happened to our three element regulators?

A little thought will reveal that the spring is only reverse loading, added to overcome the loading which the weight of the moving parts added. It also serves to make regulator closing action more positive. Thus, while some of the loading is in reverse, it is still loading and we find in the regulator of Fig. 4(B) three loading elements—pressure, weight and spring. But the regulator is still a basic three element regulator—measuring, restricting and loading.

Tests reveal that this regulator in Fig. 4(B), like the spring loaded regulator in Fig. 3, delivers a somewhat lower downstream pressure each time flow increases. Again the restricting element assumes a certain position for every rate of flow and downstream pressure. In the case of the Fig. 4(B) regulator, however, the drop in downstream pressure from no flow to full flow is very much less. This would indicate that a smaller change in downstream pressure is required to cause the restricting element to open up further to take care of the new flow condition. The regulator in Fig. 4(B) may be said to have a "proportional band" which is narrow as compared to that at the regulator in Fig. 3.

Let us now compare the experimental regulator in Fig. 4(B) with one of its commercial versions in Fig. 5(A), or Fig. 5(B) where the commercial version is shown in simplified schematic form.

The measuring element is the bourdon tube, the restricting element a double ported balanced valve and the loading elements are diaphragm pressure, spring force and weight of moving parts. As downstream pressure increases, it tries to straighten out the bourdon tube and in doing so takes the flapper away from the diaphragm pressure bleed hole. As the flapper moves away from the bleed hole, diaphragm pressure falls, allowing the spring to start to close the restricting element and bring the downstream pressure back down again. In case downstream pressure starts to fall too low, the bourdon tube lets the flapper close off the bleed hole and the diaphragm pressure builds up to push open the restricting element.

There is an orifice (just back of the bleed hole) in the pressure line to the diaphragm which is too small to pass as much gas as the bleed hole when the flapper is pulled away. Also, the commercial version has adjustment features for changing downstream pressure, proportional band, etc. You will note the use of a pressure regulator in the pressure line to the diaphragm. We have already mentioned the breaking of diaphragms from excess pressure on the

second regulator discussed. So the little auxiliary regulator limits the diaphragm pressure in case the flapper is held up against the bleed hole.

There are a great many applications where high quality and precision performance are neither needed nor wanted —a service regulator, for example, of the type installed on domestic customer's premises.

### *Service Regulators*

The service regulator must be safe, dependable and not too expensive. The inlet pressures are not very high and the flow capacity required is not very great. Such a regulator, built almost exclusively for gas service installation is shown in Fig. 6(A) with a cutaway sketch in 6(B). Basically, this is the same as the spring loaded regulator. In this regulator is built a feature not seen in any of the previous ones. This feature is a little curved pitot tube reaching from the chamber beneath the diaphragm to a point in the downstream gas passage. This point has been chosen because, as gas flow increases past it, the pressure there falls through venturi action. This artificially low pressure is the one measured by the diaphragm. The diaphragm then calls for a wider open restricting element and we have a regulator with a "rising characteristic." As flow increases, you would normally expect the outlet pressures to fall; but this feature causes the downstream pressure to remain constant or even to rise a little. This characteristic overcomes the drooping tendency noted on the spring loaded regulator first discussed.

The weight loaded regulator we built second in Fig. 2(B) has something in common with the spring loaded regulator in Fig. 3 and with the regulator in Fig. 6(B). All three can be labeled "self-operated," since they all get the energy necessary to open or close the restricting element from the gas flowing through the line.

On the other hand, the first regulator, the "small boy" regulator in Fig. 2(A), and the improved regulator with a bellows measuring element in Fig. 4(B) also have something in common. They both amplify or supplement the energy of the measuring element in order to open or close the restricting element. They both can be labelled "relay-operated." As a matter of fact, any gas regulator can be classified as either self-operated or relay-operated.

You have two tools with which to sort out the essential elements of any regulator built. First, you can determine whether the regulator is self or relay operated; second, you can break your regulator down into three essential elements —measuring, restricting and loading. By the time you have done this, there isn't much you don't know in a practical way about a regulator.

The most important characteristics of diaphragms are flexibility, strength and resistance to the action of gas and air. A number of materials such as Neoprene, Buna-N, Mycar, or other rubberlike synthetics are widely used, ordinarily strengthened by a fabric insert.

In springs we find that the "rate" of the spring is an important characteristic. The usual spring employed in regulators has the faculty of compressing or shortening its length in equal steps. A given spring of a certain "rate" will shorten ½" if subjected to five pounds of force. Add another five pounds and it shortens another ½". Thus a total of ten pounds shortened it one inch. Add another ten pounds and it shortens another inch. Take off five pounds and it lengthens ½". This spring has a rate of ten pounds or is known as a "ten pound spring."

Whenever a spring is used for part or all of the loading element, there will be some "positioning" action. This is the relation between the downstream pressure and the position of the restricting element. This accounts for the deviations from the set-point which occur with a spring loaded regulator when the flow changes. Such a deviation is called an "off-set." Off-set may be overcome by some means as the pitot tube employed in the gas service regulator illustrated in Fig. 6(B). Or it may be reduced or increased at will by the use of a relay operated regulator which can amplify the measurement it makes to apply loading.

### *Offset and Error*

Some regulators do not have "off-sets." Such a regulator is the one you built with weight loading illustrated in Fig. 2(B). No spring is employed and the force exerted by the weight does not change as the restricting element is opened or closed. Theoretically, the downstream pressure is the same regardless of flow. Essentially the same may be said of the lever and weight loaded regulator in Fig. 2(C).

What these weight loaded regulators have, rather than "off-set," is "error." This error is introduced by friction of moving parts, resistance of the diaphragm to change and in the case of the lever and weight loading, the angularity of the lever arm. The combined effects of all these introduce error but they must be present to prevent "hunting" on the part of the regulator. As you can see from Fig. 2(B) or (C), the moving parts float to produce a floating action type of control. If no friction were present, the moving parts would float right on past the set-point when correcting a change in downstream pressure. They would float right back past again, still hunting but never settling on the desired set-point. Sometimes this is so violent as to throw the weights off the lever arm. So a little friction is necessary to absorb the energy of the oscillations. This accounts for the fact that "error" exists in downstream pressure in "floating" action regulators.

Completely pressure loaded regulators or "pressure balanced" regulators have floating action but are relatively stable and need less friction since they do not have the inertia effect introduced by weight loading and have the damping action obtained by compressible gases.

Hunting or cycling which can occur in spring loaded regulators is avoided by damping, introduction of demand side capacity, and proper valve size selection. Many factors enter into valve selection and many shapes, sizes and materials are available for various desired characteristics. Valves may be had for quick opening service, throttling service, 100 per cent shut-off service, corrosive service and so on. Sizing of valves is almost always done from capacity charts provided by most manufacturers.

This chapter on Elements of Gas Pressure Regulators was prepared by Robert C. Lisk, Fisher Governor Company, Marshalltown, Iowa. A second chapter on pressure regulators will discuss their use in transmission and distribution lines.

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# Production of Retort Coke Down 54 Per Cent

Production of retort coke in the United States in 1950 decreased 54 per cent from the 1949 total, according to data submitted by gas utility companies to the Bureau of Mines, United States Department of the Interior. During 1950, four plants closed their coal gas operations and dismantled all of their retorts while three additional plants were idle, but carbonizing equipment was to be maintained for standby purposes.

Only 15 plants were active at the close of the year, but several of these were scheduled to discontinue coal gas production in the first part of 1951. The drop from 96 plants, which produced nearly 900,000 tons of retort coke in 1942, to the 15 in operation at the close of 1950 is due to a number of economic factors: (1) high cost, due chiefly to the large amount of labor required and to high coal costs; (2) the rapid extension of high pressure transcontinental natural gas pipe lines into many areas formerly served by coal gas plants; and (3) small gas utilities have found it profitable to change to the distribution of liquefied petroleum gases.

The quantity of bituminous coal carbonized in gas retorts in 1950 dropped 52 per cent from the 1949 figure while the average cost of coal increased four per cent to $11.41 per ton. Although no data are collected on manufacturing costs, nor on the production and sale of gas, it is evident from the data collected that the revenue obtained by the gas utilities from the sales of coke, tar, and other chemical raw materials represents but a fraction of total manufacturing costs.

More than 77 per cent of the retort coke produced is used within the producing plants principally for making producer, or water gas, and for heating retorts (bench fuel).

## Accident Criteria

*(Continued from page 12)*

drab, every accident is deadweight. The more than 5,000 disabling injuries in the gas industry last year represent a burden and a drag on the men and management of the gas industry, and the public which the industry serves.

Effective accident prevention doesn't distinguish between major and minor injuries. The gas industry, however, is obviously letting the little ones get away. The industry should tolerate its many minor injuries no more than a community should tolerate a major epidemic.

## Gas Use for Electric Generation Reaches New Peak in May

Electric utility power plants consumed 70,574,124,000 cu. ft. of gas in May, a record total which was 4.8 per cent above the previous high of 67,335,869,000 cu. ft. burned in August of 1950, the Federal Power Commission reported early in July in its monthly publication "Consumption of Fuel for Production of Electric Energy."

The May 1951 gas use was 19.9 per cent above the 58,843,924,000 cu. ft. consumed the preceding month, and exceeded the May 1950 total by 32.1 per cent.

## Montana Power Plans Import Of Canadian Gas

The Montana Power Company, of Butte, Mont., has filed an application with the Federal Power Commission proposing the construction of pipe line facilities which would be used to import natural gas from fields in Alberta, Canada, into Montana.

The company plans to import the gas from fields in the Pakowki Lake area in southeastern Alberta. The application says that the most recent estimate of the gas reserves in those fields—Pendant d'Oreille, Manyberries, Smith Coulee and Black Butte—is 488.5 billion cu. ft. of gas in place, 434.2 billion cu. ft. recoverable, and 406 billion cu. ft. not gas marketable. The gas is to be produced and transmitted in Canada by two newly formed subsidiaries of Montana Power.

The facilities to be used in the proposed importation of natural gas include about 18 miles of 16-inch line extending from the Pakowki Lake area to a point on the Canada-Montana border, and approximately 52 miles of 16-inch line extending from that point to a connection with Montana Power's existing system near Cut Bank, Mont. The 18 miles of line would be owned and operated by one of the new subsidiaries of Montana Power.

Montana Power said the gas reserves now available to it are depleted to a point where it will become necessary to curtail industrial gas loads unless a new source of supply can be obtained. Montana Power's principal industrial customer is Anaconda Copper Mining Co.

The application did not give an estimate of the cost of constructing the proposed new pipe line facilities.

## FPC Announces Amendment To Regulations

The Federal Power Commission has issued an order amending its regulations under the Natural Gas Act relating to requirements for filing applications for authorization to export or import natural gas.

The amendment is designed to eliminate the requirement previously contained in the Commission's rules that the owner of a source of supply of natural gas who proposes to export or import natural gas or who has entered or proposes to enter into a contract to supply natural gas to be exported or imported shall be a necessary party to an application for the authorization required under the Natural Gas Act.

The amendment is effective immediately.

## FPC Makes Kallina Chief Of Certificates Div.

The Federal Power Commission has appointed Carl T. Kallina Chief of its Division of Gas Certificates to succeed Loring E. Heckman, who resigned to enter private industry.

One of the original employees engaged in gas certificates work since the amendment to the Natural Gas Act in 1942, Mr. Kallina is a native of Brookline, Mass., and is a graduate of Northeastern University, Boston. Prior to joining FPC in 1941, Mr. Kallina was a gas engineer with subsidiary companies of the Washington Gas Light Co.

## Northern Natural Plans Expansion Program

The Federal Power Commission has granted temporary authorization to Northern Natural Gas of Omaha, Neb., to construct pipe line facilities which will increase the capacity of its natural gas transmission system north of Kansas by 50 million cu. ft. per day, to a total of 650 million cu. ft.

The commission said it was acting to enable the company to meet emergency 1951-52 winter peaks, and that the authorization is at the sole risk of Northern without prejudice to final commission action.

The 50 million cubic foot increase is part of a larger expansion program in which Northern is proposing to construct facilities to bring the daily total capacity of its system north of Kansas up to 825 million cu. ft.

The entire construction program, including the facilities authorized by the temporary certificate, is estimated to cost $33,095,000, and consists of a total of 221.8 miles of pipe line additions in Texas, Oklahoma, Kansas, Nebraska and Minnesota, and compressor additions totaling 84,000 horsepower in Texas, Kansas, Nebraska and Iowa.

The facilities authorized by the temporary certificate include 79.5 miles of pipe lines and 27,200 horsepower in compressor additions.

## Proportion of Homes

*(Continued from page 14)*

areas that did not have free extension allowances and nearly 65 per cent of these used gas for one or more purposes.

The fact that only one-third of the new single family dwellings outside the free extension allowance areas used gas for one or more purposes is causing a number of gas utilities to re-examine their service extension policies. Multi-family dwellings outside the free allowance areas showed better acceptance since more than 63 per cent of these selected gas for one or more of the residential services. The survey showed that builders or new home owners are reluctant to install gas services if they have to contribute to the cost of main extensions.

The proportion of non-users was lower for natural gas companies than for other categories. This is considered an encouraging trend, in view of the rapid growth of natural gas services into new areas, particularly in the northeastern states. Manufactured and liquefied petroleum gas utilities reported only about one out of ten new private homes built beyond the free extension allowance areas installed any gas services. About 40 per cent of new private homes built beyond the free allowance areas in natural gas territories used gas for one or more purposes.

### Appliance Acceptance

The survey revealed comparisons as to the relative degree of acceptance of various gas appliances. The use of gas for cooking was considered satisfactory in areas served by each of the types of gas and in both single family dwellings and multi-family units built within the free allowance areas. This substantiated previous findings that competition was making its greatest gains in areas beyond gas utility mains.

The study also showed a strong tie-in between the use of gas for space heating and for water heating. Almost seven out of every eight new single family dwelling units within the free extension allowance areas installed gas space heating equipment. This proportion might have been greater except for restrictions which were effective in some areas. Utilization of gas for house heating induced its use for water heating, as indicated by the fact that over 95 per cent of gas-heated homes also used this fuel to heat water.

## Clarence H. Waring Honored By Standards Association

Clarence H. Waring, vice-president, The Gas Service Company, Kansas City, has been awarded a certificate of service by the American Standards Association in recognition of his work in the development of American Standards. Mr. Waring is a member of the ASA Standards Council, representing the American Gas Association.


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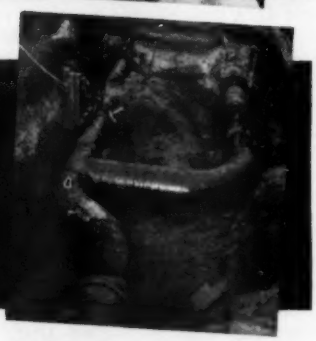

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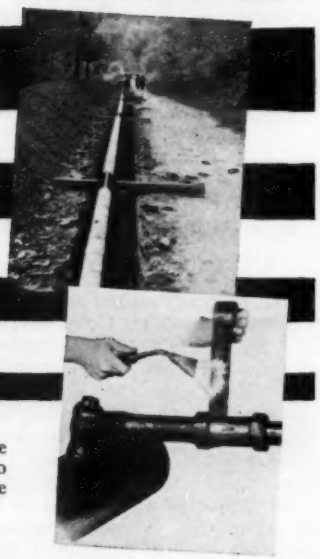

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# News of the Gas Industry

## American Meter Elects Four Vice-presidents

Donald C. Wiley

D. Clark Struble

A. E. Weingard

A. W. McW. Wolfe

American Meter Company has announced election of A. W. McW. Wolfe, Donald C. Wiley, Archie E. Weingard, and D. Clark Struble as vice-presidents.

Mr. Wolfe is a graduate of Johns-Hopkins University, with a degree in mechanical engineering. He was employed by the American Meter Company, Maryland Meter Works, Baltimore, in 1919. He has served in various capacities with the company, and was made assistant manager of the Maryland plant in 1928. In 1934 he was transferred to the Boston factory as assistant manager, and was promoted to manager in 1945.

Mr. Wiley, who will be in charge of research, was graduated from Purdue University in 1931. He became associated with American Meter Company in 1947 where he supervised the main research laboratory in Erie.

Mr. Weingard, who will be in charge of production, became associated with American Meter in 1947 as supervisor of methods. He studied and recommended procedures and methods for more efficient operational programming in the various plants.

Mr. Weingard is a graduate of the General Electric Technical Engineering School.

Mr. Struble will be in charge of purchasing. He received his education in Sharpsville, Pa. In 1928, he joined American Meter at the Erie plant. In 1946, he became manager of the production control section at Erie, and in this capacity assumed purchasing duties. Since 1946 he has served as general purchasing agent.

E. J. Mowry was appointed personnel director of the company. Mr. Mowry attended the University of Pennsylvania, and joined American Meter in 1937.

## Ralph L. Boyer Wins Lamme Medal

Ralph L. Boyer, vice-president and chief engineer of The Cooper-Bessemer Corporation, Mount Vernon, Ohio, has been awarded the Lamme Medal, one of Ohio State University's highest honors. The 1951 awarding of the Lamme Medal was made to Mr. Boyer for the development of today's gas-diesel engine and the high compression spark-ignited gas engine.

The annual conferring of this medal for meritorious achievement in engineering is a result of an endowment to Ohio State University by Benjamin G. Lamme, former chief engineer of the Westinghouse Corporation who initiated practically all design calculations that go into the construction of generators and motors. Chosen this year by the faculty committee of the College of Engineering, Mr. Boyer is the twenty-fourth Ohio State graduate so honored from over ten thousand Ohio State engineering graduates since 1892.

While an undergraduate, and 2 years after graduation in 1924, Mr. Boyer worked with Dr. Elmer Sperry in the pioneering development of the compound diesel engine. In 1926, he joined The Cooper-Bessemer Corporation as diesel engineer; was made assistant chief engineer in 1929 and chief engineer in 1938. In 1947, Mr. Boyer was elected vice-president and in 1950, a director of the company. In 1950, on behalf of the American Society of Mechanical Engineers he presented a paper on America's progress in engine development before the World Power Conference.

## E. J. Menerey Retires as V-P Of South Jersey Gas Co.

E. J. Menerey retired as vice-president of South Jersey Gas Company, Atlantic City, N. J., on August 1, according to an announcement by Earl Smith, president.

Explaining that reasons of health necessitated the retirement, Mr. Smith said that the loss of Mr. Menerey would be keenly felt by the company.

Mr. Menerey also served as head of the company's Glassboro division. He continues on the company's board of directors.

Mr. Menerey entered the gas industry in 1916, following his graduation from Michigan State College. He served as production superintendent for gas companies in Lansing, Mich.; Freeport, Ill., and Wilmington, Del.

He was made manager of the Peoples Gas Company, Glassboro, in 1928, and in 1930 became its president. When South Jersey Gas Company was formed in 1947 by the merger of Peoples Gas Company and the former Atlantic City Gas Company, he became vice-president of the new company.

Mr. Menerey is a director and past president of New Jersey Gas Association. He is also a director of New Jersey Utilities Association.

## Jac A. Cushman, AGA Editor, Recalled to Service

Jac A. Cushman, editor of American Gas Association *Monthly*, has been recalled to active duty as a captain in the US Air Force. During his absence, editorship of the *Monthly* will be assumed by Laurance C. Messick, formerly news editor of *American Machinist Magazine*, and editor-in-chief of *Crockery and Glass Journal*.

Mr. Cushman joined AGA in 1947 after serving as assistant financial editor of The Hartford *Courant*, morning newspaper in Hartford, Conn. A graduate of Trinity College, he served in the Air Force for three and a half years during World War II.

## Thomas B. Gregory Is Dead

Thomas Barger Gregory, a pioneer in the development of the petroleum and gas industry in Pennsylvania, Ohio, West Virginia, Texas and Oklahoma, died in Pittsburgh on July 11. Born October 15, 1860, in Philadelphia, Mr. Gregory was in his 91st year. He formerly was president of Manufacturers Light and Heat Company, Pittsburgh (1921-27) and chairman of the board of Manufacturers from 1927 until his retirement in 1944. Mr. Gregory played an important part in the organization of the Ohio Fuel Corporation, which later merged into Columbia Gas & Electric Corporation. He retired as vice-president and director of Columbia, also in 1944.

Mr. Gregory started his business career in Foxburg, Pa., in 1878 when, in company with Frank B. Dale, a boyhood friend, he purchased oil property along the Clarion River from associates of John D. Rockefeller, Sr. He took part in the expansion of natural gas service to various Pennsylvania towns, merging activities under the Union Light & Heat Company. In 1895 he formed a partnership with Harry J. Crawford, of Emlenton, Pa., which partnership continued throughout his lifetime.

Messrs. Gregory and Crawford, in company with M. C. Treat and George W. Crawford, obtained an interest in the Lone Star Gas Company of Texas in 1909, and a few years later various oil and gas properties were purchased which ultimately led to the creation of the Quaker State Oil Refining Corporation, of which Mr. Gregory remained a director until the time of his death.

In 1929 Mr. Gregory became a vice-president of the Lone Star Gas Corporation and then chairman of the board of its successor Lone Star Gas Company, being actively engaged in the operations of that company at the time of his death.

Mr. Gregory also was chairman of the board and treasurer of Western Public Service Corporation and its successor, Mountain Fuel Supply Company. He resigned as chairman in March 1951, but remained as a director. He was connected with many other companies, either as an officer or a director.

## Plan Increased Deliverability From Underground Storage

Southern California Gas and Southern Counties Gas of California have filed a joint application with the Federal Power Commission asking authority to build a 23.5-mile natural gas pipe line extending from Inglewood to Los Angeles.

Estimated cost of the proposed 30-inch line is $2,611,875.

The application says that the primary purpose of the proposed line is to increase deliverability of gas, withdrawn from the La Goleta, Calif., underground storage field, to the Los Angeles metropolitan area.

Johnson-Williams, Ltd. manufacturers of combustible gas indicators and alarms for industrial and marine application, double their production space at their Palo Alto, Calif., plant. New facilities will be devoted to laboratory and machine-shop operations.


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## Gilbert N. Bell Joins Staff Of Sprague Meter

Gilbert N. Bell

Gilbert N. Bell is now on the sales force of the Sprague Meter Company, Bridgeport, Conn. He will cover the northeast territory in conjunction with H. Ward Cheeseman.

Mr. Bell was with the Consumers Power Company in Michigan. He started his service with them at Jackson as a meter repairman, later becoming meter supervisor at Saginaw and was subsequently promoted to meter supervisor for the Pontiac division. He has had twenty years service in gas distribution and meter maintenance.

## Sweeney and Anthes Promoted By Brooklyn Union

J. Gordon Sweeney, who has held the post of assistant chief chemist at the laboratory of The Brooklyn Union Gas Company since 1940, has been appointed chief chemist. Mr. Sweeney has been with Brooklyn Union for twenty-three years, having entered company employ as a senior chemist at Greenpoint Works in 1928. Before he was chief chemist of the Domestic Coke Corporation of Fairmont, West Va., and, previously, a research chemist with the Mellon Institute.

John F. Anthes, formerly assistant to chief chemist, has been appointed assistant chief chemist. Mr. Anthes, associated with Brooklyn Union since 1920, has a wide background of chemical experience, including fifteen years as a lecturer in gas engineering at the Polytechnic Institute of Brooklyn.

## Mississippi River Fuel Changes Underground Storage Plans

Mississippi River Fuel Corporation, of St. Louis, Mo., has filed an amended application with the Federal Power Commission in connection with its proposal to develop the Waterloo (Illinois) oil field as an underground storage reservoir for natural gas.

The amended application was filed following tests of the field made pursuant to a temporary certificate granted by FPC January 12.

As now proposed, the project would include about 16.2 miles of pipe line; an estimated 25 wells for the introduction and withdrawal of gas; an 1800 horsepower station for compressing gas for injection into the reservoir; a dehydration plant with a capacity of 75 million cu. ft. per day; liquid separators; pressure regulating and metering stations.

Total investment cost of the project is estimated at $2,953,125.

## FPC Suspends and Rejects Rate Increases for Tennessee Gas

The Federal Power Commission issued an order on July 13 suspending and rejecting proposed rates submitted by Tennessee Gas Transmission Company, of Houston, Texas, which would have increased its total revenues for the 12 months ending July 31, 1952, from $83,300,000, estimated under present rates, to $99,600,000.

The rates which were suspended cover sales of natural gas in Louisiana, Mississippi, Tennessee, Kentucky and West Virginia and would have increased the cost of gas to Tennessee's customers in these states by $13,600,000. The rates are suspended pending hearing and decision, and their use is deferred until December 16.

The rejected rates cover service principally in Ohio, Pennsylvania and New York and would have increased the cost of gas to Tennessee's customers by $2,700,000.

The commission accepted for filing new emergency service rates proposed by Tennessee and instituted an investigation to determine whether such rates are just, reasonable, and nondiscriminatory.

Tennessee's proposed rate increase, which was to have become effective July 16, would affect all of its customers, but principally United Fuel Gas Company, of Charleston, W. Va., and Hope Natural Gas Company, of Clarksburg, W. Va. The rates to United would have been increased by $7,750,000, and to Hope by $3,960,000.

Tennessee contends that the higher rates are necessary because of increases in taxes and cost of labor.

## Coupland Heads New Development Division of Koppers Division

Walter F. Perkins, vice-president and general manager, metal products division of Koppers Company, Inc., has announced the appointment of Major General R. C. Coupland (USAF retired) as manager of a newly created product development department of the division.

General Coupland will supervise and coordinate all activities in connection with product development, improvement and acquisition, Mr. Perkins said.

## David Patterson Heads Servel Sales Promotion

David K. Patterson has been named sales promotion manager of Servel, Inc., manufacturer of motorless refrigerators, gas water heaters and "all-year" air conditioners. His appointment was announced by John K. Knighton, general sales manager.

Mr. Patterson has been with Servel since 1947, serving successively as public relations copywriter, dealer magazine editor, and assistant sales promotion manager. Before joining Servel he was a reporter and feature writer on the *Evansville Press*.

## Edward H. Ryan Appointed By Drake & Townsend

Edw. H. Ryan

Edward H. Ryan has been appointed field supervising engineer by Drake & Townsend, New York propane engineering company.

Mr. Ryan will cover New England and eastern seaboard points operating from Providence, R. I., supervising installations of Draketown propane plants for gas utilities and industrial users.

Mr. Ryan has been well known in the industry for many years.

## Matheson Co. Now Offering Natural Gas in Cylinders

The Matheson Co., Inc. of East Rutherford, N. J., and Joliet, Ill., is now supplying research laboratories and pilot plants throughout the country with Texas natural gas in cylinders. The natural gas has a specific gravity at 60°F. of 0.6019 and a heating value of 1036 Btu per cubic foot at 60°F. An average analysis of this gas shows it to contain approximately 93 per cent methane. The gas is packaged in steel cylinders of 1800 psi., and each cylinder contains approximately 200 cubic feet.

## Index of Yields

*(Continued from page 23)*

be maintained with the understanding that the subscriptions are intended to be brought up to the existing margin requirements for a general account (meaning 75 per cent cash) within nine months.'

This warning, instead of diminishing purchases through rights on a 25 per cent basis, actually might increase the practice by focusing attention on it. While stock purchases thus effected have had a great deal to do with success of recent rights offerings of new common stock, the shares so acquired constitute —in the opinion of the writer—a 'speculative suspense account to be held only temporarily for larger than normal income return and possible capital appreciation. Stock from a previous stock offering held for the prescribed nine months' period, as outlined in the Federal Reserve Board rule permitting such purchase, conceivably might finds its way into the market at just about the time the utility company concerned finds itself in need of additional common stock money. In such event the lightly margined stock then seeking a buyer might constitute a deterrent to the second stock offering.

## House Heating $ Contest Announced by AGA

Awards totaling $1,000 for outstanding contributions in the field of gas house heating during the period of September 1, 1950 to September 1, 1951, have been announced by the American Gas Association. The contest is sponsored by the Coroaire Heater Corp., Cleveland.

The awards will consist of five cash prizes of $500, $250, $150, respectively, for the first three winners and prizes of $50 each for the fourth and fifth winners. The contributions on which the awards will be judged may include gas heating sales and promotional programs to consumers, dealers, architects or builders; a gas heating research project; product development; an address before a gas industry meeting or an article in a gas trade paper. The field is not limited to these activities and contributions can include any other activity outstanding in its aid to the advance of gas heating.

Entries must be in the mail or received at American Gas Association headquarters not later than midnight, September 1, 1951.

All awards will be made by a jury of awards consisting of an executive representative of American Society of Heating and Ventilating Engineers; an executive of Gas Appliance Manufacturers Association; one representative each of the Manufactured and Natural Gas Departments of AGA, and an executive representative appointed by the president of AGA. The awards will be presented at the annual AGA convention in St. Louis, Missouri, in October.

## New Coal Process

*(Continued from page 26)*

The Aluminum Company of America has selected Milam County, Texas, as the site of a new aluminum smelting plant that will have a capacity of 85,000 tons of metal annually with initial production scheduled for the fall of 1952.

The large amounts of electricity required by the new plant will be generated by steam-driven equipment using as fuel lignite processed by the Bureau's carbonization method. Power generating facilities will be built and operated by the Texas Power and Light Company.

Reserves of lignite in Milam County are known to total more than 100,000,000 tons, and exploration work now in progress is expected to add to this figure. It can be extracted both by strip and slope mining at an estimated cost of $1.00 to $1.50 a ton.

Raw lignite, containing some 35 per cent moisture, has a heating value of 7,000 Btu per pound, but the bone-dry char obtained after processing this lignite has a heating value of 10,600 Btu per pound.

In the Bureau's process lignite or other low-rank non-coking solid fuel is crushed to ¼-inch particles or smaller. To remove the moisture, the crushed fuel is "boiled" at 350 degrees Fahrenheit in a fluidized dryer that uses the hot products of combustion or flue gas as the heating medium. Then the hot dry fuel is moved pneumatically to a carbonizing reactor, where it is burned with air at a temperature of 950 degrees Fahrenheit to extract the tar oils and obtain a char.

The process also is applicable to synthetic liquid fuels production in two ways. First, it yields tar oils that can be hydrogenated, using relatively little hydrogen, to produce quality synthetic liquid fuels ranging from heavy industrial fuel oil to aviation gasoline. Second, the carbonizing equipment can be used to extract oil from oil shale fines now discarded because they cannot be handled in most of the pilot plant shale retorts under study.


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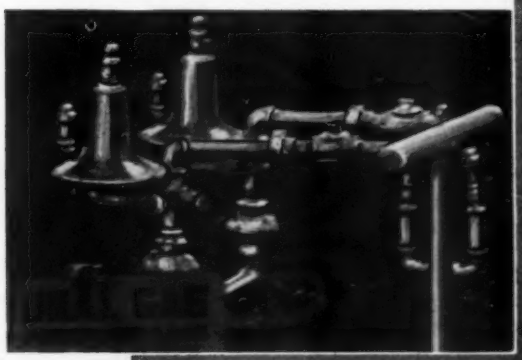

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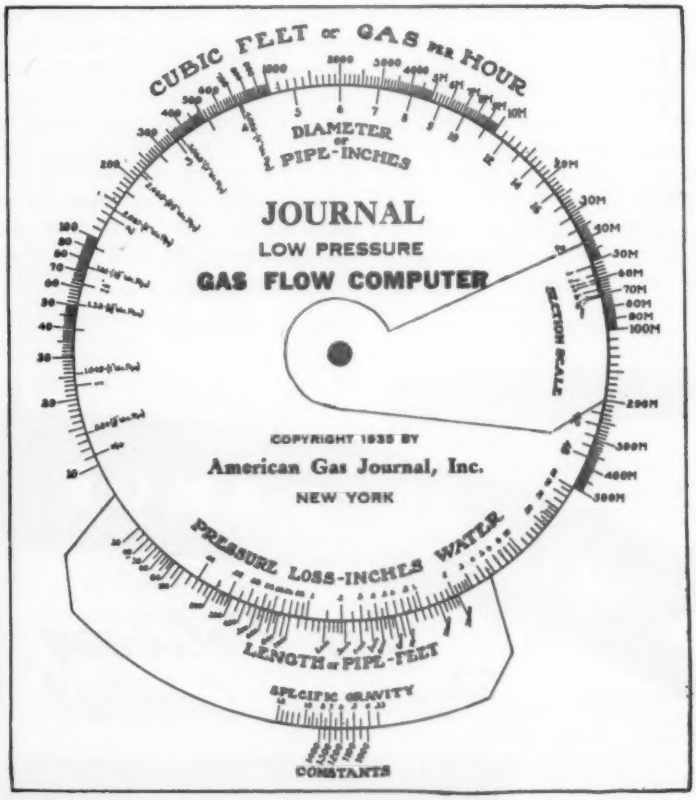


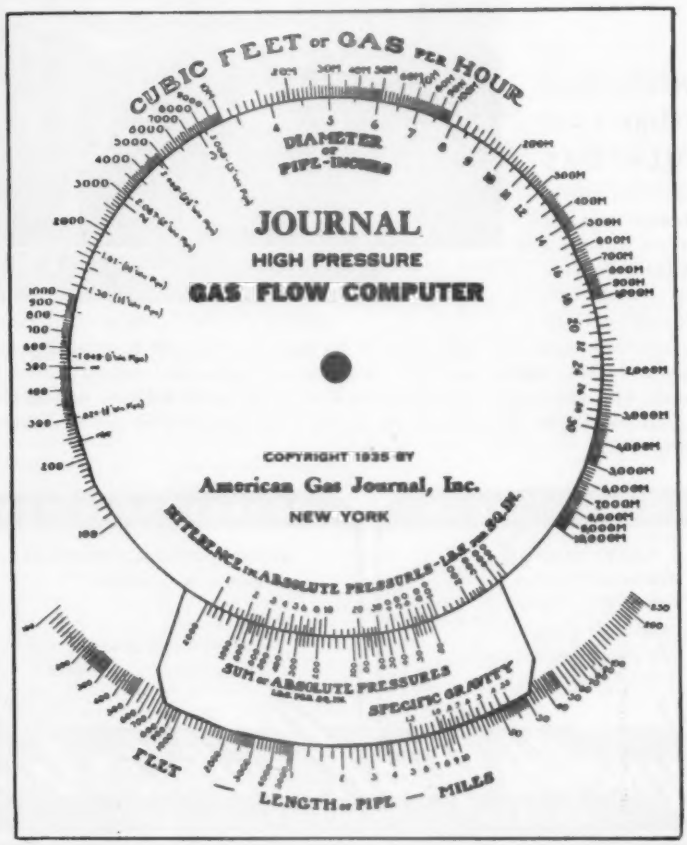


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## Higher Court Decisions

*(Continued from page 22)*

tion commission approved certain gas rate schedules as filed and requested by the gas corporation which includes what is designated as "rate schedule PG". Under rate schedule PG a rate for gas to industrial consumers is at a price substantially higher than is established by schedule I-1, in order that large industrial gas consumers who are not desirous of rate schedule I-1 may contract with the gas corporation for uninterruptible gas, and thus have priority of gas service over customers served under rate schedule I-1.

On March 28, 1950 several industrial gas consumers being served under rate schedule I-1 filed suit in the district court and asked the court to command the Oklahoma Natural Gas Company to furnish natural gas suitable to their needs and wholly without reference to contracts executed with other consumers under the new rate schedule PG. It was contended that the corporation commission order of July 6, 1949, was invalid; that the rates, contracts, and practices under the schedules I-1 and PG result in unlawful discrimination against gas users on the I-1 rate.

The gas corporation's counsel argued that the contracts for lower gas rates with chances of interrupted service and higher gas rates for uninterrupted service are valid because the corporation commission has proper authority to put into effect both rate schedule I-1 and rate schedule PG. Nevertheless, the district court held invalid these gas rate schedules of the corporation commission.

The Supreme Court reversed the district court's decision, and in holding the rate schedules valid, said:

"It is urged that the order of July 9, 1949, was invalid for lack of notice to gas consumers, but such notice was not a prerequisite to entering the order. No challenge is made of the authority of the corporation commission in the regulation of public utilities and we deem it unnecessary to here cite the constitutional and statutory provisions which authorize the corporation commission to prescribe rates and regulations in the sale and distribution of natural gas."

Also, the Supreme Court upheld the validity of an existing state law that the District Court had no authority to declare invalid rate schedules and regulations prescribed by the corporation commission. This law is as follows: No court of this state, except the Supreme Court, shall have jurisdiction to review, affirm, or reverse, or remand any action of the corporation commission with respect to the rates, charges, services, practices, rules or regulations of public utilities, or of public service corporations, or to suspend or delay the execution or operation thereof, or to enjoin, reverse, or interfere with the corporation commission in the performance of its official duties.

### Must Have Authority

Considerable discussion has arisen from time to time over the question: "Is a city ordinance valid which requires gas corporations to pay to a city, tax for use of its streets?"

A recent higher court answered this question in the negative.

For example, in City v. Public Service Company, 97 N. E. (2d) 268, it was shown a city enacted an ordinance which provided that a fee of four per cent of gross receipts be paid the city by the gas corporation, as compensation for the use of streets, alleys, sidewalks and parkways, by mains, pipes, and conduits.

In subsequent litigation, the higher court held the ordinance void. This court explained that a municipal corporation has no inherent power of its own, and that such powers are wholly acquired by grant from the general assembly, and that no grant of power had been


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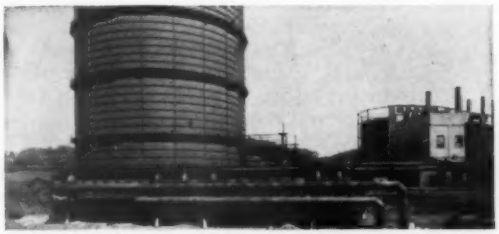

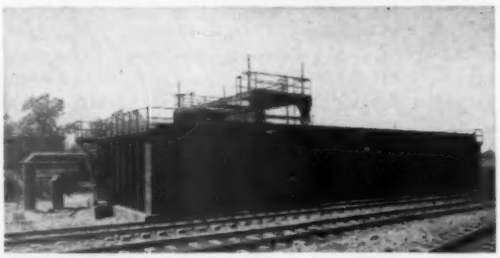

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made by the state permitting cities to charge for the use of streets, or for exacting a privilege tax based upon the gross revenue of a taxpayer using the streets. The court said:

"We think the ordinances involved in this case are subject to the same criticism. It is our judgment and opinion that the ordinances of the city are invalid and unenforcible."

### Eminent Domain

Generally speaking, a higher court will uphold a jury's damage allowance to a property owner whose property is condemned and appropriated by a gas corporation.

For example, in Reinsch v. Cities Service Gas Co., 223 Pac. (2d) 741, a gas company sought a gas pipe line right of way easement across premises owned by three property owners. The jury awarded $480.00 to the owner of approximately 80 acres of which four acres were actually taken for right of way purposes; $100.00 to the owner of five acres of which one-half acre was taken for the pipe line; and $320.00 to the owner of six and one-half acres of which one acre was taken for the pipeline right of way.

In subsequent litigation the higher court approved the jury's verdict, and said that the property owners were entitled to only as much money as the actual value of the land appropriated by the gas corporation.

### Incident to Employment

A higher court recently held that an employe is entitled to receive compensation under the state workmen's compensation act for an injury he sustained while doing something to benefit the gas company. This is so although the employe sustained the injury while acting outside the scope of his employment.

For example, in Oklahoma Natural Gas Company v. Nickens 189 Pac. (2d) 184: An employe of the Oklahoma Natural Gas Company was injured while lifting a heavy box in a department different from where he regularly worked. Compensation was refused on the basis that the employe was employed in the engineering department of the company, and that he was *not* attending to his regular duties when he lifted the box in another department.

Nevertheless, the higher court awarded compensation to the employe saying that when the work of an employe is connected with the gas company's business and beneficial to the company, the employe is protected by the provisions of the state workmen's compensation act.

# AGA Nominating Committee Makes Report For Officers for Coming Year

Gas industry executives of thirty-two companies located in nineteen states and in Canada have been nominated as officers and directors of the American Gas Association. This list of nominees, which includes representatives of manufactured, mixed and natural gas companies as well as manufacturer and holding companies, will be placed before the membership for election at the 1951 AGA Convention in St. Louis, October 15-17.

The following list of nominations will be placed before the AGA membership for election:

For president:—George F. Mitchell, president, The Peoples Gas Light and Coke Company, Chicago.

For first vice-president:—Charles E. Bennett, president, The Manufacturers Light and Heat Company, Pittsburgh.

For second vice-president:—Earl H. Eacker, president, Boston Consolidated Gas Company, Boston.

For treasurer:—Edward F. Barrett: —president, Long Island Lighting Company, Mineola, New York.

For director:—Two-year term expiring October, 1953—B. C. Adams, president, The Gas Service Company, Kansas City, Missouri; M. A. Abernathy, vice-president, United Gas Pipe Line Company, Shreveport, Louisiana; L. L. Baxter, president, Arkansas Western Gas Company, Fayetteville, Arkansas; Ralph L. Fletcher, president, Providence Gas Company, Providence, Rhode Island; J. A. Fry, president, Detroit-Michigan Stove Company, Detroit, Michigan; R. M. Heskett, president, Montana-Dakota Utilities Company, Minneapolis, Minnesota; E. G. Lawson, president, Pacific Public Service Company, San Francisco, California.

Also nominated as directors for two-year terms were: J. F. Merriam, president, Northern Natural Gas Company, Omaha, Nebraska; Dean H. Mitchell, president, Northern Indiana Public Service Company, Hammond, Indiana; J French Robinson, president, Consolidated Natural Gas Company, New York; Louis Ruthenburg, chairman of the board, Servel, Inc., Evansville, Indiana; Earl Smith, president, South Jersey Gas Company, Atlantic City, New Jersey; Paul R. Taylor, vice-president, Stone & Webster Service Corp., New York; Thomas Weir, general manager, Union Gas Company of Canada, Ltd., Chatham, Ontario, Canada; and J. Theodore Wolfe, executive vice-president, Consolidated Gas Electric Light and Power Company of Baltimore, Maryland.

Section and general committee nominations were as follows:

Accounting Section: for chairman—Ralph F. McGlone, Cleveland commercial manager, The East Ohio Gas Company, Cleveland, Ohio; for vice-chairman: Bernard S. Rodey, Jr., assistant secretary, Consolidated Edison Company of New York.

Industrial and Commercial Gas Section: for chairman—Ronald A. Malony, executive vice-president, The Bridgeport Gas Light Company, Bridgeport, Connecticut; for vice-chairman: Terry Hart, general sales manager, Nashville Gas and Heating Company, Nashville, Tennessee.

Residential Gas Section: for chairman—William J. Schmidt, assistant vice-president and general sales manager, Long Island Lighting Company, Mineola, New York; for vice-chairman: Raymond J. Vandagriff, general sales manager, Laclede Gas Company, St. Louis, Missouri.

Operating Section: for chairman—H. Bruce Andersen, vice-president in charge of distribution, The Philadelphia Gas Works Company, Philadelphia; for vice-chairman: Channing W. Wilson, research chemist, Consolidated Gas Electric Light and Power Company of Baltimore, Baltimore, Maryland.

Manufacturers Section: for chairman —Gordon LeFebvre, president, The Cooper-Bessemer Corporation, Mount Vernon, Ohio.

Laboratories Managing Committee: for chairman—Arthur F. Bridge, president and general manager, Southern Counties Gas Company, Los Angeles, California; for vice-chairman: Charles E. Bennett, The Manufacturers Light and Heat Company, Pittsburgh, Pennsylvania.

Publicity and Advertising Committee: for chairman—C. J. Allen, vice-president (retired), The Connecticut Light and Power Company, Waterbury, Connecticut; for vice-chairman: Harold E. Eckes, director of advertising and publicity, The East Ohio Gas Company, Cleveland, Ohio.

## New Bulletin Describes Dry Seal Holder

A new bulletin (WG-22) just released by the General American Transportation Corporation, 135 S. LaSalle Street, Chicago, describes in detail, by means of simple drawings and explanatory text, the principle of the Wiggins dry seal gas holder.

Until recently most Wiggins gas holders were in use in the petroleum industry, saving gasoline vapors expelled from storage tanks.

Their use has now been expanded into storage of practically every type of gas known. Their particular advantage in the gas industry lies in the fact that they require no servicing, since there is no water, tar nor grease in the seal.

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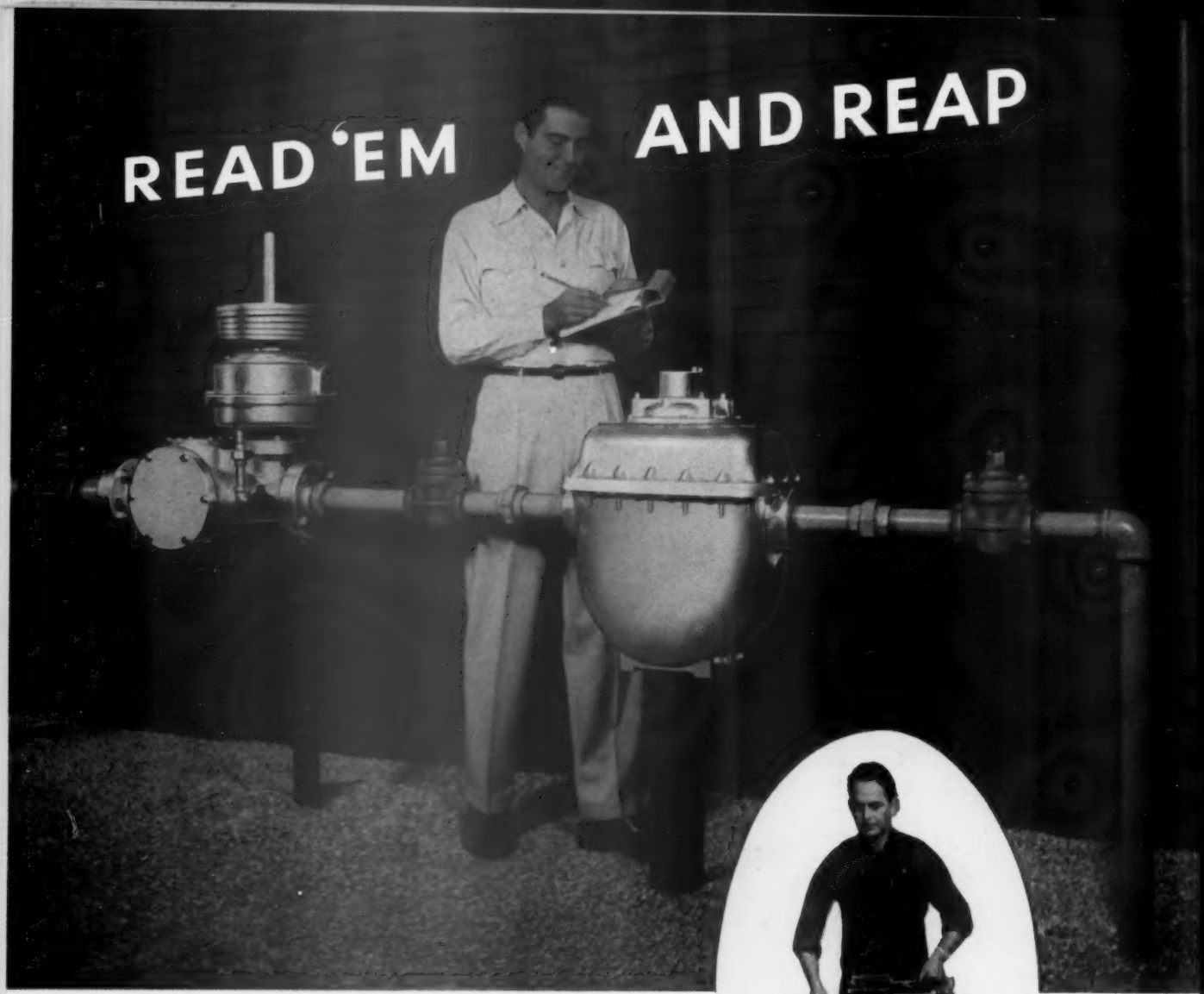

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## New York State Natural Makes Several Promotions

George M. Daudet has been appointed chief engineer of New York State Natural Gas Corporation's Tonkin station, located near Murrysville, it is announced by John J. Jacob, Jr., vice-president.

Until the time of his promotion Mr. Daudet had been assistant chief engineer at Preston station near Waynesburg. He began his 11-year term of service with The Peoples Natural Gas Company, sister company of New York State Natural, at Imperial station.

Mr. Daudet will succeed Melbourne L. Blue at Tonkin station as chief engineer. Mr. Blue has been named chief engineer at New York State Natural's new South Bend station.

Roy C. Patterson has been appointed district superintendent of New York State Natural. Mr. Patterson's district, with headquarters at Tonkin station in Murrysville, will be known as New York State Natural's southern district.

Don C. Wise has been appointed chief engineer of New York State Natural's Oakford station.

The new station, now under construction at Delmont, Pa., near Jeannette and Greensburg, will cost $7,500,000.

Mr. Wise has supervised construction of compressing installations for The Peoples Natural Gas Company and New York State Natural in Truitsburg, Pa., Therm City, New York, and Sabinsville, Pa.

## Eagen Is Research Metallurgist For Cooper-Bessemer

The promotion of Thomas E. Eagan to the new position of research metallurgist has been announced by Ralph L. Boyer, vice-president and chief engineer of The Cooper-Bessemer Corporation. "The new post of research metallurgist," explains Mr. Boyer, "is another important step in Cooper-Bessemer's program of development work in the design and manufacture of engines and compressors. In his new post, Mr. Eagan will direct his energies to furthering Cooper-Bessemer's experience in the field of nodular iron and other engineering metals for its own production needs."

Mr. Eagan's former laboratory supervision now becomes the responsibility of W. R. McCracken who will be in charge of Cooper-Bessemer's foundry research laboratories in Grove City, Pennsylvania. Mr. McCracken will also supervise the materials control of Cooper-Bessemer foundry operations in both its Mount Vernon, Ohio, and Grove City, Pa., plants.

## Vulcan Rubber Appoints Three New Salesmen

Vulcan Rubber Products, Inc., Brooklyn, N. Y., announces the appointment of three new members to its sales staff.

Lyle Goodman will represent the company in the Detroit area, Garvice Hill will cover Texas and adjacent territory, and T. P. Connelly will cover the Mid-Atlantic states.

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Approved by American Gas Association

## United Gas Changes Plans For Off-Shore Pipe Line

The Federal Power Commission has authorized United Gas Pipe Line Company, of Shreveport, La., to alter its plans on a natural gas pipe line to be built in the Gulf of Mexico off the coast of Louisiana, a change which will save 247 tons of pipe and $128,000 in construction cost.

The company will build approximately 11 miles of 14-inch line instead of 12.3 miles of 14-inch line as previously authorized. Under the new plans, the line will originate at United's platform in Block 32 approximately 1,000 feet from the Pure Oil Company's drilling platform and extend southwesterly to a platform operated by Magnolia Petroleum Company, Continental Oil Company and Newmont Oil Company in Block 51.

## New York State Natural Plans More Underground Storage

New York State Natural Gas Corporation, partner of Texas Eastern Transmission Corporation in developing a $40,000,000 storage pool near Jeannette, Pa., is simultaneously engaged in preparatory work on another $8,969,100 gas storage pool in Pennsylvania's Armstrong and Indiana Counties.

Specifically situated in South Bend and Plum Creek Townships of Armstrong County and Armstrong Township of Indiana County, this latter project, the South Bend storage pool, is being groomed to allow, ultimately, for the underground storing of 13 billion cubic feet of gas. When completed, the pool will have a deliverability capacity of 264,000,000 cubic feet of gas a day.

Additional gas to be made available through operation of the pool will benefit customers of both The Peoples Natural Gas Company and The East Ohio Gas Company, sister companies of New York State Natural. Anticipations are that 8,200,000,000 cubic feet of gas will be stored in the pool by October of this year. It is expected that 4,200,000,000 cubic feet will be withdrawn for use by Peoples and East Ohio during peak periods through the winter months to March 1952. But plans call for the storing of a billion cubic feet of gas over the same period. Thus, the contemplated storage inventory for March, 1952, would be five billion cubic feet. It is expected that the goal of storing 13 billion cubic feet will be reached in October 1952.

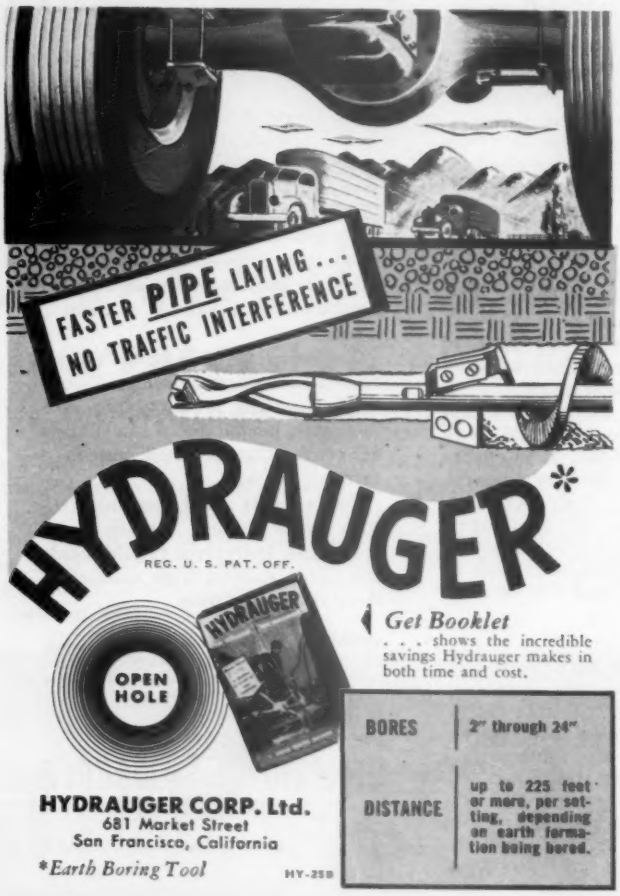
At the South Bend storage site, which will be acquired by New York State Natural from Peoples, work is currently progressing at a rapid pace on the reconditioning of old wells and the construction of a modern 12,000 horsepower compressing station. The Fish Engineering Company, builders of several Peoples stations, has the contract.

In a report prepared by Richard J. Murdy, geologist, and R. D. Loughman, geological engineer, under the supervision of Fenton H. Finn, vice-president of New York State Natural and chief geologist for Consolidated Natural Gas Company, it is pointed out that development of the South Bend pool will require reconditioning 51 active wells and redrilling 28 abandoned wells.

Excerpts from a summary of the same report follow:

"The proposed South Bend gas storage pool is strategically located with respect to the transmission system of New York State Natural Gas Corporation, The Peoples Natural Gas Company, and The East Ohio Gas Company. A study of the sand conditions shows that the pool is a closed reservoir. It is capable of deliverabilities ranging from 264 million cubic feet of gas per day when filled to capacity, declining to 100 million cubic feet of gas per day at conclusion of the withdrawal period. The proposed South Bend storage area possesses all of the desirable characteristics as to location, reservoir capacity, and deliverability to make it a valuable and useful facility for rendering more effective service to consumers."

As a further phase of the same project, New York State Natural is currently laying a 77-mile 20-inch line from the storage area to the Petersburg measuring station on the Ohio-Pennsylvania line.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# Interchangeability—A Review

Edwin L. Hall and E. J. Weber

American Gas Association Laboratories, Cleveland

Interchangeability of fuel gases has been one of the major problems of the gas industry since the time that the first gas-making process, other than coal gas, was considered. With the development of new processes and with the widespread availability of natural gas in the United States, interchangeability has developed into a major problem for most companies supplying utility gas.

It should be understood that the problem of interchangeability depends upon an individual set of circumstances. These circumstances are frequently unique to each utility company. Points of similarity exist but no universal answer is apparent.

Interchangeability should be first expressed as either complete, that is where the supplemental gas is exactly the same as the base gas, or second, satisfactory, where the supplemental gas may be used without producing an amount or character of complaints which cannot be handled by the system's engineers, or third, suitable for emergency operation, when many desirable characteristics must be sacrificed in order to avoid complete outage of gas supplies.

If we consider the appliances on any one distribution system, we must conclude that they are adjusted according to a somewhat distorted probability curve. Because the usual utility company has expended considerable time and effort in obtaining the best possible adjustment of customers' appliances, the number of satisfactory adjustments is much greater than would be expected from the ordinary probability curve. However, in spite of this effort, adjustments will be made by others and changes in adjustments will occur due to dust and lint accumulations, etc. which will cause some complaints even if there is no change in gas composition. There will then be a second group of appliances which will stand some variation in gas composition but which will be sensitive as compared to the majority of appliances on the line. It is this group of sensitive appliances that are normally selected as measures of what tolerances may be permitted in substitute gases.

These marginal appliances will usually tend to be those with small combustion chambers, high port loadings, or air shutter adjustments that tend to be critical. Appliances with relatively small combustion chambers will not tolerate an increase in the size of the flame without some impairment to complete combustion. This increase in size of flame may be due to an increase in pressure, an increase in thermal value, a decrease in specific gravity, or a change in chemical composition.

Appliances with high port loadings will tend to be critical if the supply of gas changes so that the flame is over-aerated and will either move towards lifting or alternately if under-aerated may quickly develop yellow tips. Appliances with critical air shutter adjustments will permit little variation in the quality of the gas before they fail due either to a lack of primary air or an over supply of primary air.

Most companies are familiar with the types of appliances that show these critical behaviors and use them as an index of system performance. No practical substitute for such an index has been found.

The variations that may be considered in the type of supplemental gas that may be used are, however, so tremendous that the gas industry has given a great deal of time and attention to the development of indices that may serve as a preliminary basis for considering whether or not a particular gas may offer probabilities of satisfaction. It has long been known that the primary properties to be considered in burner performance could be grouped into specific gravity, Btu., chemical characteristics, and pressure variations. All four are somewhat interdependent and it is, of course, true that most supplemental gases are used on peak load when pressures may be variable and when the problem is further confused by variations in the other three properties.

Work at the AGA Laboratories has developed such factors as the "C" factor, various interchangeability factors for natural gas, and various curves to indicate the limits of burner performance. Messrs. Knoy, Shnidman, and others have developed methods and formulae that are very useful for preliminary analyses; but like all factors, these formulae have tended to be abused by over-extension into fields not proposed by those who originally developed such aids to interchangeability analysis.

Excerpt from paper presented at Operating Section meeting, AGA, New York, 1951.

## Kansas-Nebraska Seeks Sanction To Expand Facilities

Kansas-Nebraska Natural Gas Co., Inc., of Phillipsburg, Kans., has applied to the Federal Power Commission for authority to construct additional pipe line facilities in Nebraska and Colorado to increase the capacity of its natural gas transmission system from the presently authorized 164,200,000 cu. ft. per day to 182,600,000 cu. ft. daily.

The facilities, estimated to cost $976,330, would be used to provide additional gas for the increased demands of the company's existing markets and to serve new markets in Nebraska and Colorado.

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# Kansas City Safety Conference Lists Dramatic Subjects

Preparation against attack and sabotage is one of the dramatic subjects to be discussed at the second annual safety conference sponsored by the Accident Prevention Committee of the American Gas Association at the Hotel Phillips, Kansas City, Mo., on September 17 and 18. Human relations in accident prevention, new methods of resuscitation, and safe practices in gas production also are timely and pertinent subjects on the two-day program that will be of vital interest to all gas industry safety executives.

### Kansas City Disaster

W. H. Adams, safety director, The Manufacturers Light & Heat Co., Pittsburgh, and chairman of the AGA Accident Prevention Committee, will preside at the conference. Delegates will be welcomed at the opening session by B. C. Adams, president, The Gas Service Company, Kansas City. They will have an opportunity to witness the heroic efforts of a devastated city in battling back to normalcy after a terrible disaster.

Dr. A. E. Neyhart, Pennsylvania State College, will speak on the subject of safe driving at the morning session, Monday, September 17. Dwight Sargent, personnel director, Consolidated Edison Company of New York, will discuss the human relations aspects of accident prevention from a background of experience with one of the largest public utility companies in the world.

E. A. Koenig, general superintendent, Texas Eastern Transmission Corporation, will talk on compressor safety at the afternoon session on Monday. With the rapid growth of natural gas transmission lines into manufactured and mixed gas areas, safety in compressor stations becomes more important in the public eye. Precautionary measures in drilling and in tapping lines under pressure are additional subjects listed on the program for Monday.

### Production Practices

Safe practices to be followed in the production of water gas and coal gas will be discussed on Tuesday morning. William J. Alexander, Public Service Electric & Gas Co., Newark, N. J., and Walter J. Deveney, The Peoples Gas Light & Coke Co., Chicago, are scheduled to head these discussions. Safe measures in hunting for gas leaks and safe practices in handling materials, are marked for discussion at that session.

E. S. Beaumont, The Peoples Gas Light & Coke Co., Chicago, chairman of the program committee for the Conference, will preside at a luncheon meeting on Tuesday. D. A. Hulcy, president of AGA will present awards for outstanding gas industry safety performances at the luncheon meeting. Mr. Hulcy, who is president of Lone Star Gas Company, Dallas, Texas, and president of the United States Chamber of Commerce, is actively interested in accident prevention. Improvement of gas industry accident prevention records is one of the primary objectives to be achieved during his term in office as president of AGA.

### Defense Measures

"Be Prepared for Sabotage or Attack" is the opening subject of the afternoon program on Tuesday. Lt. Colonel Frank E. Costanzo, of Pittsburgh, has been selected to talk on this subject. As a member of the Ordnance Department of the Organized Reserve Corp., Colonel Costanzo is presently assigned to 2201-Research and Development Group, and is well acquainted with subversive and undercover tactics used by enemy fifth columns.

J. E. Carnehan, The Peoples Gas Light & Coke Co., Chicago, will present some of the latest methods of resuscitation and his talk will be followed by showings of movie films and sound-slide presentations available for use as visual aids in improving accident prevention records of gas utilities.


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## AGA Issues Bulletins on Studies on Combustion of Industrial Gases

The Committee on Industrial and Commercial Gas Research of the American Gas Association has issued two reports which the committee believes will furnish the foundation for new approaches and new thinking on methods of burning industrial gas to meet the new conditions required by the nation's accelerated production processes. The bulletins are reports on research projects.

"Advanced Studies in the Combustion of Industrial Gases—Part II" is the second report issued on methods of increasing the number of Btu's from industrial gas in a given space and in a given time. Part I of this report presented some experimental views of the application of the principle of detonation to the burning of industrial gas. Part II of the report by Dr. John J. Turin, University of Toledo and Jack Huebler, Surface Combustion Corporation, Toledo, further attempts to develop theories of detonation that would apply to industrial gas when fed at continuous rates.

Another PAR Plan exploration into new ways of burning industrial gas in the future is recorded in the report "Gas-Air-Oxygen Combustion Studies." With the advent of lower cost oxygen of commercial purity, and with the prospect of still lower costs, the use of oxygenated air for many high temperature industrial heating operations becomes a distinct possibility.

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### EMPLOYEES HANDY DATA

**Northern Natural Gas Company**

**Information Based on Year End 1950**

—

Full Time Regular Employees ..... 1603
Northern ..... 1425 Female ..... 175
Peoples ..... 178 Office ..... 343
Male ..... 1428 Field ..... 1260
Consolidated Gross Property Account, $166,309,098
Gross 1950 Additions to Property ..... $50,591,880
Northern ..... $49,902,802
Peoples ..... $ 689,078
Number of Utility Customers ..... 27
Market Area—Five States of Iowa, Nebraska, Minnesota, South Dakota and Kansas.
Number of Meters Attached to System ... 613,839
Number of Heating Customers ..... 297,418
Number of Communities Served ..... 229
Population Served ..... 2,077,795
Average Gas Rate per MCF ..... 17 cents
Yearly Gas Sales in MCF ..... 167,286,347
Operating Revenue ..... $32,786,978
Net Income ..... $5,837,906
Earnings Per Share ..... $2.13
Dividends Per Share ..... $1.80
Daily Pipeline Capacity in cu. ft. ..... 600,000,000
Miles of Pipeline ..... 6176
Tons of Steel in Pipelines ..... 591,000
Number of Compressor Stations ..... 23
Installed Compressor Horsepower ..... 183,360
Number of gas wells attached to system ..... 1,133
Northern ..... 253
Others ..... 880

(OVER)

Acres of Leaseholds ..... 1,151,077
Under Gas Purchase Contracts ..... 758,735
Company-Owned ..... 392,342
Total Gas Reserves in cubic feet ..... 5.56 trillion
Shares of Common Stock Outstanding ... 2,740,500
Number of Stockholders of Record ..... 15,838
Largest Percent Owned by any one Stockholder of Record ..... 2.9%
Stock Listing—New York Stock Exchange.
Stock Transfer Agents:
The U. S. National Bank of Omaha, Chemical Bank & Trust Company, New York.
Stock Registrars:
The Omaha National Bank, Central Hanover Bank & Trust Company, New York.
Number of Directors ..... 7
Burt Bay (Deceased January 31, 1951.)
John Merriam — Farrar Newberry
Hiram Carson — Mark Adams
Max Miller — Guy Reed
Incorporation Date ..... April 25, 1930
Service Awardees ..... 641
5-Year—296 — 15-Year—130
10-Year—195 — 20-Year—20
Number of Company Airplanes ..... 4
Three Single Engine
One Twin Engine
Number of Two Way Radios ..... 207
Mobile ..... 168
Dispatch Points ..... 13
Fixed ..... 26
Subsidiary Company:
Peoples Natural Gas Company serves 88 communities.

Reproduced here are both sides of a "bill fold" card containing company data, issued by Northern Natural Gas Company, Omaha, Neb. The card was inserted in the regular edition of the company's employee magazine, W. J. Quinlan, editor. His editorial comment was: "A well informed employee makes for a good employee."

Mr. Quinlan has extra copies of the card for those who are interested.


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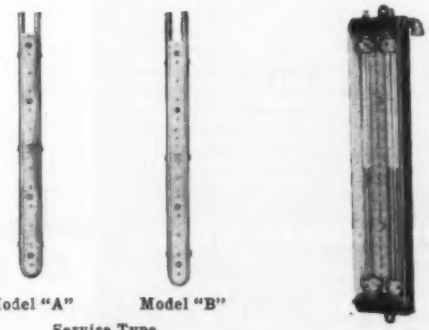

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## Meiller and Markle Increase Royalty Rates

D. V. Meiller and M. G. Markle, inventors of a system for underground storage of natural gas under high pressure, have announced that the royalty rates will be increased from 60 cents per thousand cubic feet of gas storage capacity to 75 cents per thousand cubic feet of gas storage capacity.

The Meiller-Markle natural gas storage system has been used in eleven installations storing a total of over 175 million cubic feet with additional large quantities of storage contemplated or under construction. The largest installation to date has been the 120 million cubic foot storage plant of the Public Service Company of Northern Illinois at Mount Prospect, Illinois.

Mr. Meiller and Mr. Markle, who are associated with the Public Service Company of Northern Illinois in gas engineering work several months ago announced adoption of a policy which will make available to any prospective user of the system a license under their patent rights at a low uniform royalty rate.

Licenses, they said, will be granted to any responsible parties who wish to install or have installed a high pressure gas storage system covered by their pending patent application.

The underground gas storage system developed by Meiller and Markle already has been used successfully in large capacity installations.

In the light of constantly increasing demands for natural gas, the Meiller-Markle high pressure, underground storage system has recently attracted considerable attention from utility companies and manufacturers interested in the storage of natural gas for reserve or emergency supplies.

## Hope Natural Asks Increase Of $5 Million

Hope Natural Gas Company of Clarksburg, W. Va., has applied to the Federal Power Commission for an increase in its rates applicable to wholesale service to six utility customers, of approximately $5,500,000 or 16 per cent based on anticipated sales for the year ending August 30, 1952. The company proposes to make the increased rates effective September 1, 1951.

The proposed increase is in addition to an increase of about $2,000,000 proposed in 1949 and now before the commission. Thus, the total increases sought amount to approximately $7,500,000.

The prior increase was suspended by the FPC on October 31, 1949 and was allowed to take effect on April 1, 1950 subject to posting of a bond and possible refund of any part not proved to be justified after completion of the proceeding. Hearings on this increase have been completed and the trial examiner has recommended that approximately $1,700,000 of the $2,000,000 requested be allowed. The matter is now under consideration by the commission.

Hope Natural states that the need for the new increase in rates is brought about because of the "tremendous" increase in cost of purchased gas and because of other adverse factors affecting Hope's business. The new rate increase proposal is being studied by the commission's staff.

The proposed increase in rates would be distributed among Hope Natural's six wholesale purchasers whose principal market areas include Cleveland, Akron and Canton, Ohio; Pittsburgh, Pennsylvania; and Syracuse, Rochester and Buffalo, New York.

## Precision Tools for Production Booklet Issued by Selas

The importance of heat processing machines as automatically controlled precision tools in production lines is highlighted in a new bulletin, "Precision Tools for Production," issued by Selas Corporation of America, Philadelphia 34.

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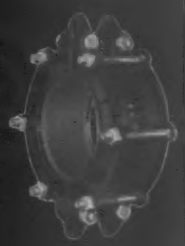

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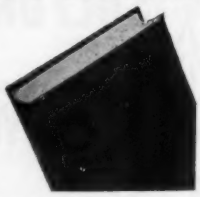

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6. How Long Should it Take?
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| 140,000' | 1½" | Standard Black Pipe, Plain Ends, 21' |
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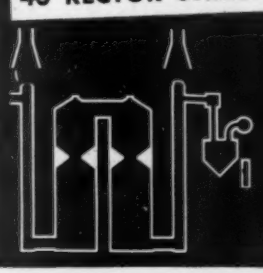

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## CONVENTION CALENDAR

**August**

21-23 PCGA Convention, Fairmont Hotel, San Francisco.

**September**

7 New Jersey Gas Association, 36th Annual Meeting, Monmouth Hotel, Spring Lake, New Jersey.

13-14 Mid-West Gas Association, School and Conference, Iowa State College, Ames, Iowa.

21 Oklahoma Utilities Association, Gas Division, Biltmore Hotel, Oklahoma City, Oklahoma.

22-23 Maryland Utilities Association, Fall Conference, Virginia Beach, Va.

25-28 The American Society of Mechanical Engineers, Hotel Radisson, Minneapolis, Minnesota.

26-28 National Metal Trades Association, Palmer House, Chicago, Illinois.

**October**

8-12 39th National Safety Congress & Exposition of the National Safety Council, Chicago, Illinois.

15-17 AGA Annual Convention, St. Louis, Mo.

22-24 33rd Annual Meeting, American Standards Association, Waldorf-Astoria, New York City, N. Y.

**November**

5-8 American Petroleum Institute, Annual Meeting, Stevens Hotel, Chicago, Ill.

8-9 Mid-Southeastern Gas Association, The Sir Walter Hotel, Raleigh, North Carolina.

25-30 American Society of Mechanical Engineers, Chalfonte-Haddon Hall, Atlantic City, N. J.

**December**

2-5 American Society of Refrigerating Engineers, Annual Meeting, Hotel Roosevelt, New Orleans, Louisiana.

3-5 Institute of Cooking and Heating Appliance Manufacturers, Semi-Annual Meeting, Cincinnati, Ohio.

5-7 National Association of Manufacturers, Annual Meeting, Waldorf-Astoria Hotel, New York, N. Y.

## Texas Gas Transmission Plans To Spend $42 Million

Texas Gas Transmission Corp. has announced a $42.3 million pipe line construction program designed to meet increasing war-time emergency needs for natural gas in its mid-western service area and in Appalachian markets.

W. T. Stevenson, executive vice-president, said the company has asked the Federal Power Commission for authority to construct 580 miles of large diameter pipe line and necessary compressor stations.

The new facilities would enable Texas Gas to increase its daily deliveries by over 200 million cu. ft. of gas a day and raise the capacity of its Texas-to-Ohio pipe line system to over 900 million cu. ft. of gas a day.

The company said that industrial development is being accelerated throughout its territory and that additional natural gas is urgently required to meet the needs of plants and labor forces devoted to the production of military material.

In addition to supplying present customers in Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, Indiana and eastern Illinois, Texas Gas will be able to sell 95 million cu. ft. of gas a day to The Ohio Fuel Gas Co., an operating company of the Columbia Gas System, serving communities throughout Ohio including Columbus, Dayton and Cincinnati.

The $42.3 million project, Texas Gas reported, will be financed through the sale of first mortgage bonds, other securities and cash on hand.

Simultaneously, Texas Gas announced it has developed a new source of natural gas in southern Louisiana that will play an important role in the company's expansion. As a first step, Texas Gas acquired Louisiana Natural Gas Corp., a gas gathering system in southwestern Louisiana that includes about 110 miles of gathering pipe lines which now distribute approximately 100 million cu. ft. of gas a day to industrial customers in the Lake Charles, Louisiana area.

Texas Gas has also formed Texas Northern Gas Corp., to provide a second gas gathering network in southwestern Louisiana.

Specifically, Texas Gas proposes to:

1. Construct 372 miles of 26-inch loop line along its present system from Bastrop, Louisiana, to Hardinsburg, Kentucky, including two lines under the Mississippi River.

2. Build a 195 mile line linking the gas gathering subsidiaries in the Gulf Coast region of southwestern Louisiana with the company's main 26-inch line in the northeastern part of Louisiana.

3. Add 13,740 compressor horsepower including a new 4,400 horsepower station near Madison, Indiana.

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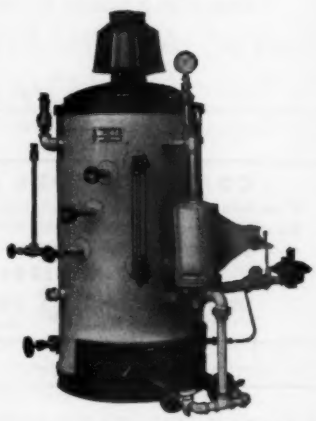

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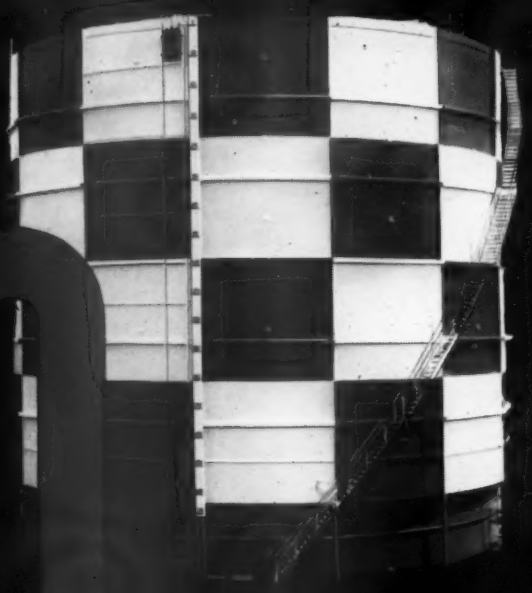

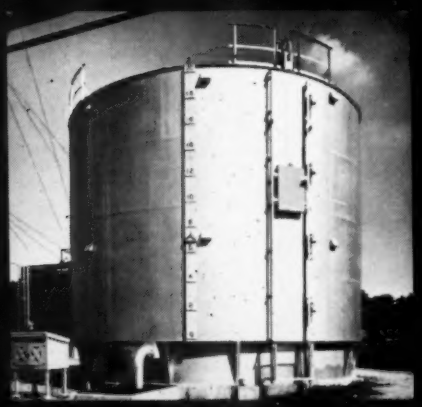

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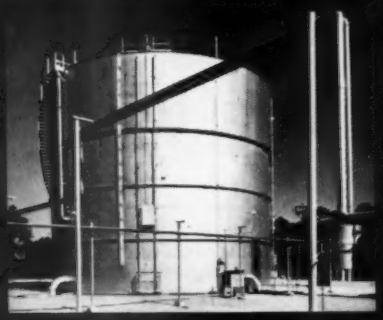

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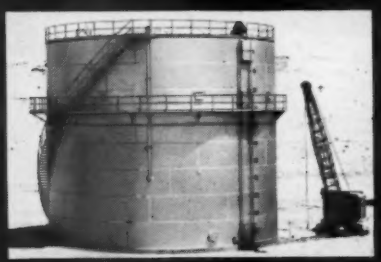

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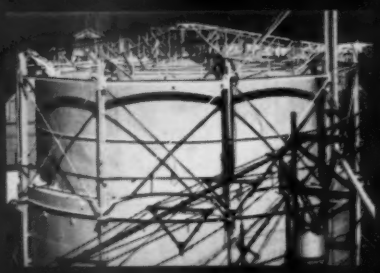

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